PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT, LANDS AND PARKS
VANCOUVER ISLAND REGION

LONG BEACH

WATER ALLOCATION PLAN

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1.0 INTRODUCTION

The Water Management Program's goals are to sustain a healthy water resource through anticipating and planning for water uses. Water Allocation Plans are a means of identifying water demands and ensuring that water use is compatible with the goals of a sustainable environment. The advantages are:

1. Water Management's position on water allocation decisions is available to applicants and public.

2. Response time is reduced.

3. Eliminates the need for individual studies and reports on each application.

4. Consistency of decisions are improved.

5. Specific allocation directions and decisions are defined.

6. Plans are more comprehensive.

7. Eliminates the need for referrals on individual applications.

The Vancouver Island Region developed the following policy to provide water allocation direction:

Regional Policy:

> **The region shall be subdivided into watershed areas and a water allocation plan shall be prepared for each watershed area. Water licence decisions will be made in accordance with approved plans.**

Assessments undertaken as part of the water allocation planning process include identifying the surface water resources available, the instream requirements for fish, the existing and potential licencable water demands and providing direction regarding further water licence allocations.

Input may be sought from other agencies. Referrals go to Federal and Provincial Fisheries agencies and to Water Management in Victoria.

2.0 GENERAL WATERSHED INFORMATION

2.1 Geography

The Long Beach Water Allocation Plan area (Figure 1) is located on the west coast of central Vancouver Island. The area encompasses Ucluelet in the south along Long Beach to the western extremity near Vargas Island. From Bedwell Inlet the plan area stretches to Bedwell Lake at the its most northern point. Then following a southeastern direction to Adder Mountain the boundary turns southwestward following a line falling east of Kennedy Lake to an area east of Ucluelet. Nine Peaks, in the northern portion of the plan area, is the highest point at 1842 m. The elevation of the land decreases toward the coast where drainages empty into the sea.

2.2 Climate

The Long Beach Water Allocation Plan area is characterized by warm, relatively dry summers and mild wet winters. Climatic normals from Environment Canada Atmospheric Environment Service (AES) stations located throughout the west coast of Vancouver Island are detailed in Appendix A. The average of these stations show August as the warmest month at 14.9°C, January as the coolest at 3.6°C with the mean annual temperature at 9.0°C.

2.3 Geology

The geological history of the Long Beach Water Allocation Plan area has been shaped by the occurrences of structural, erosion, and deposition processes. Glaciation during the Pleistocene epoch along with marine tidal fluctuations have greatly influenced the local landscape.

2.4 History

Descendants of the first peoples to inhabit the Long Beach Water Allocation Plan area include the Tla-o-qui-aht and Toquaht of the Nuu-Chah-Nulth Tribal Council. Several small communities have grown since Commissioner O'Reilly allotted reserves for First Nation's people in the 1880's. These communities include Ucluelet, Hisaawista (Esowista) and Opitsaht.

Tofino and Ucluelet are two larger communities located within the plan area. In the 1880's Ucluelet was established as a fur trading post, with a logging operation built shortly afterward. By the 1920's, fishing had developed into a primary industry. Over the

years both Tofino and Ucluelet have grown in international tourist appeal. Tourism is a thriving business offering parks, old growth forests, sandy beaches, whale watching, surfing, galleries, nature cruises, kayaking, diving, and fishing. As part of the Pacific Rim National Park Reserve is Long Beach, an 11 km stretch of surfswept sand, located along the coast between Ucluelet and Tofino.

2.5 Significant Drainage Areas

Several drainage areas were reviewed in this report for the purpose of assessing water supplies. These areas were digitized using 1:50 000 NTS maps. The following table and Figure 2 illustrate these drainage areas.

Long Beach Water Allocation Plan Significant Drainage Areas	
Drainage	**Area (km^2)**
Bedwell River	210.0
Brother Creek	1.9
Itatsoo Creek	4.5
Meares Creek	1.8
Mercantile Creek	12.9
Sharp Creek	2.4
Tofino Creek	38.6
Upper Kennedy River	217.9

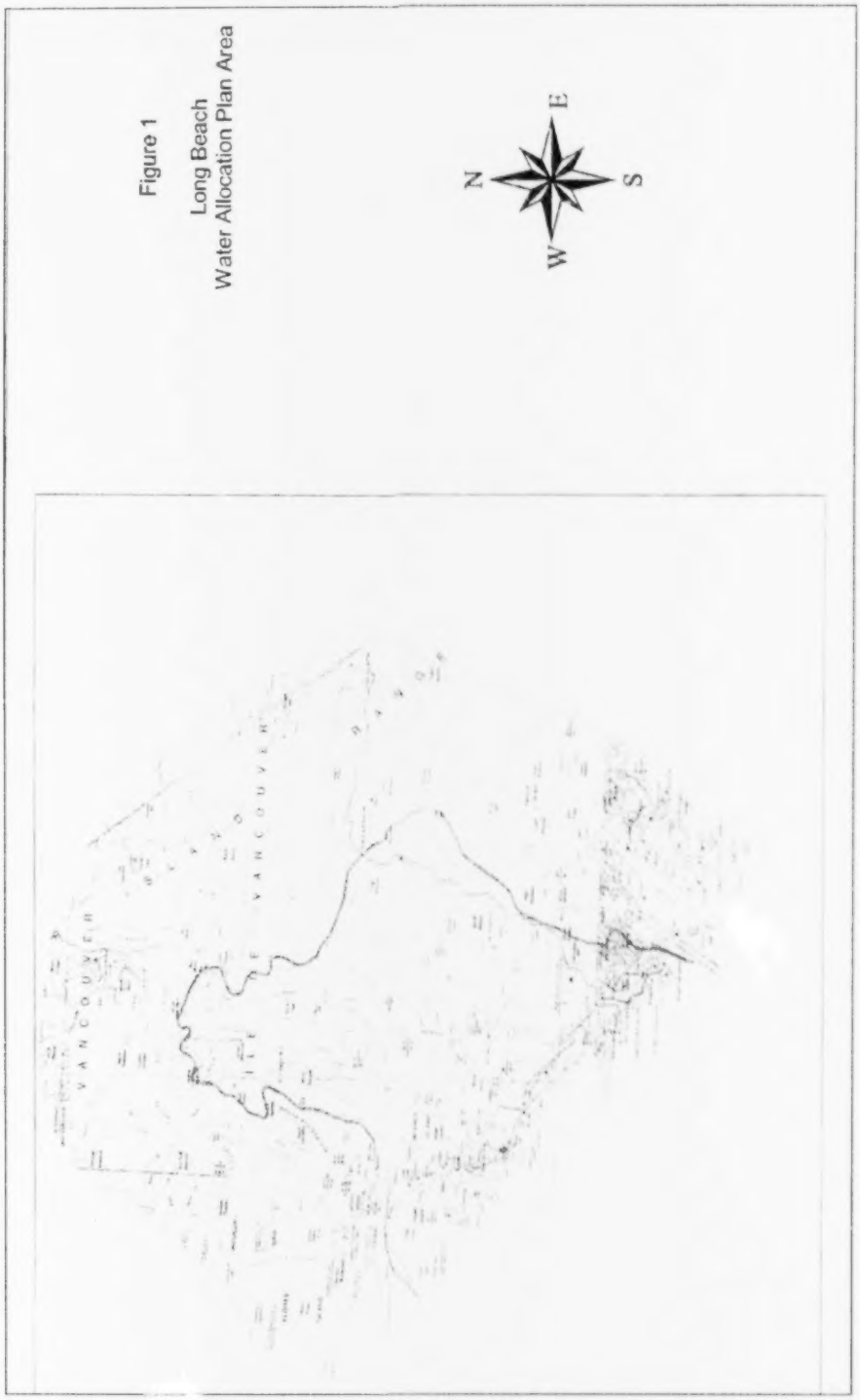


Figure 1: Long Beach Water Allocation Plan Area

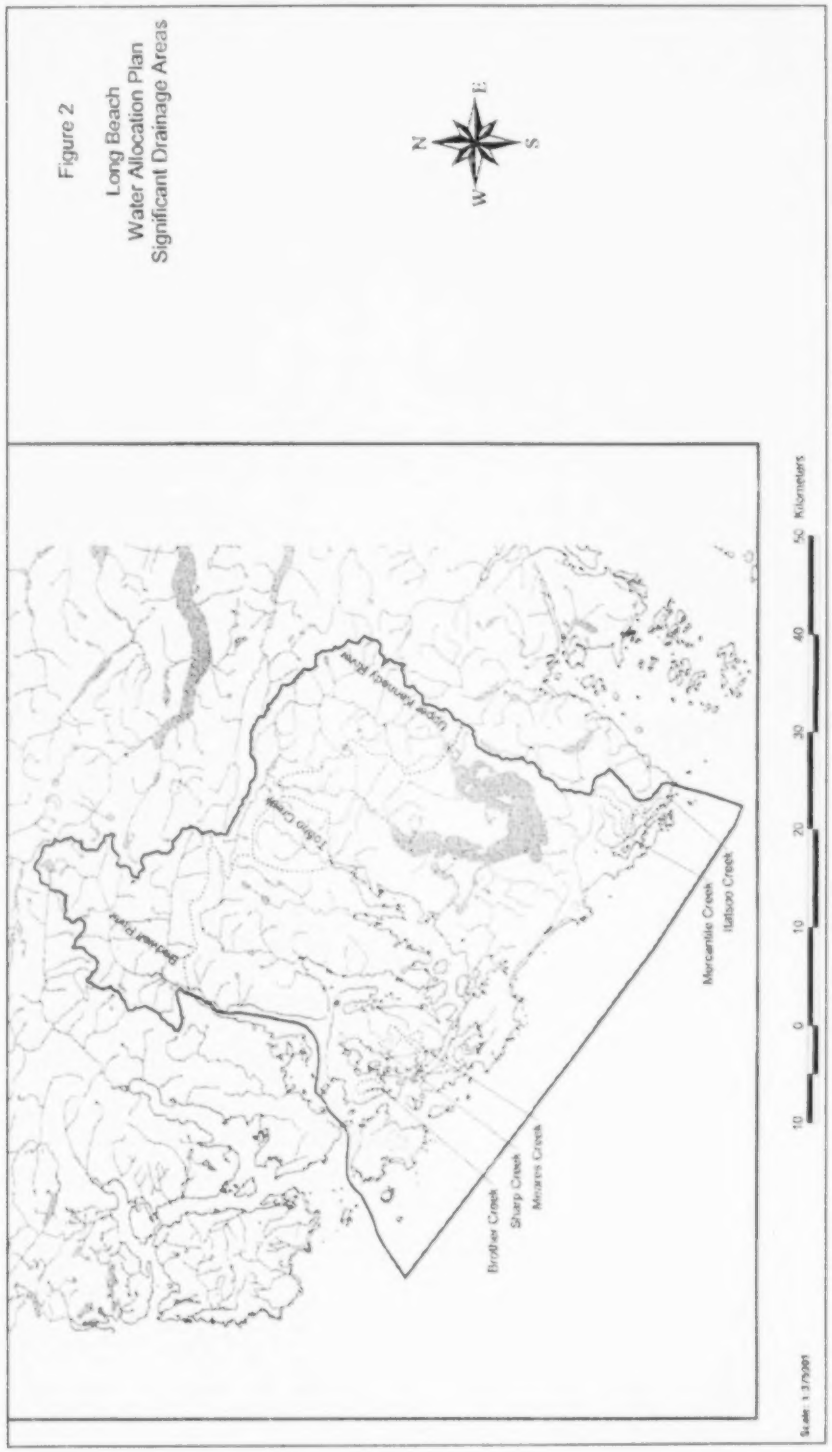


Figure 2: Long Beach Water Allocation Plans Significant Drainage Areas

3.0 HYDROLOGY

3.1 Precipitation

The average of the mean monthly precipitation normals from Bamfield East, Kildonan, Tahsis, Estevan Point, Kyuquot, Tofino, Amphitrite Point, Gold River Townsite, Cape Scott, Port Alice, and Holberg Fire Dept. Atmospheric Environment Service (AES) stations are documented in Appendix A. These stations were used to indicate overall climatic conditions for the west coast of Vancouver Island from an area around Alberni Inlet to Cape Scott. The following graph illustrates these precipitation averages.

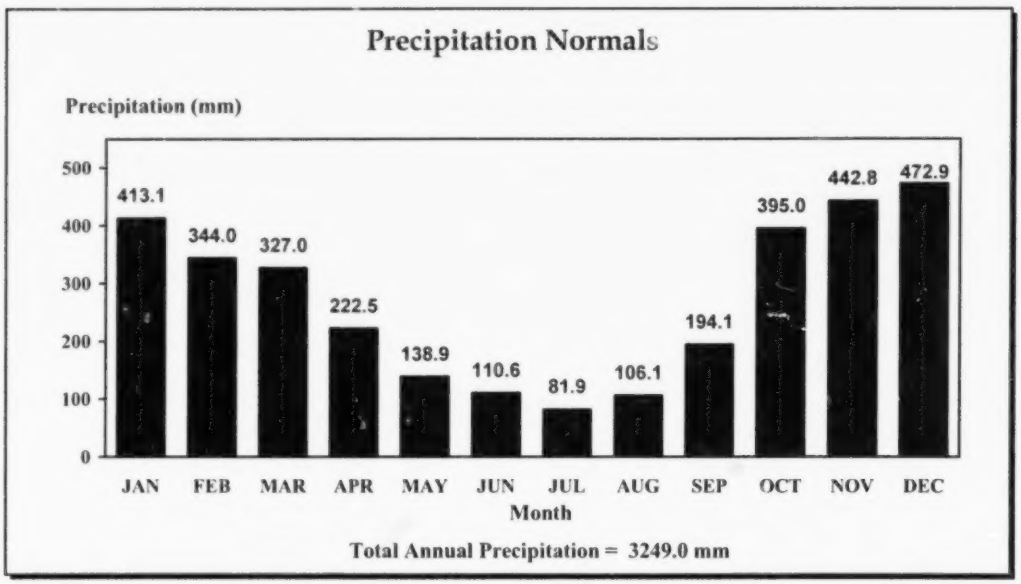


Figure 3: Precipitation Normals

The total annual precipitation in the region is 3249.0 mm. This precipitation is unevenly distributed throughout the year. As illustrated in Figure 3, precipitation levels are low during the summer months and higher throughout the winter. The minimum mean monthly precipitation is 81.9 mm in July. The maximum mean monthly precipitation is 472.9 mm in December. The average number of days with measurable precipitation is 209.

Precipitation information used in this report is based upon data available at the time of writing. A number of other studies in the Clayoquot area are anticipated to provide site specific information useful for future revisions of the Long Beach Water Allocation Plan.

3.2 Hydrometric Information

The hydrology of the Long Beach Water Allocation Plan area is similar to hydrologic patterns along the entire west coast of Vancouver Island. Two hydrologic scenarios have been established. Smaller, low elevation drainages tend to have higher peak flows and smaller low flows relative to their overall discharge volumes. Larger, high elevation drainages, while having similar discharge trends, have higher low flows and smaller peak flows relative to their overall discharge volumes. Appendix B and C describe in further detail how mean monthly and mean annual discharge estimates are derived.

3.2.1 Bedwell River Drainage

The estimated drainage area of Bedwell River where it flows into salt water (Bedwell Sound) at the mouth is 210.0 km^2.

Bedwell River flow estimates are based on Large Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Bedwell River Mean Monthly and Mean Annual Discharge (litres/second)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
33810	31080	21630	23520	25200	20790	11130	7770	10290	31500	37590	37800	23730

3.2.2 Brother Creek Drainage

The estimated drainage area of Brother Creek where it flows into salt water (Maurus Channel) at the mouth is 1.9 km^2. This drainage serves as a community watershed for the Clayoquot band.

Brother Creek flow estimates are based on Small Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Brother Creek Mean Monthly and Mean Annual Discharge (litres/second)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
344	314	241	194	91	65	32	38	61	249	382	376	205

3.2.3 Itatsoo Creek Drainage

The estimated drainage area of Itatsoo Creek where it flows into salt water (Newcombe Channel) at the mouth is 4.5 km^2. This drainage serves as a community watershed for the Toquaht band.

Itatsoo Creek flow estimates are based on Small Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Itatsoo Creek Mean Monthly and Mean Annual Discharge (litres/second)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
815	743	572	459	216	153	77	90	144	590	905	891	486

3.2.4 Meares Creek Drainage

The estimated drainage area of Meares Creek where it flows into salt water (Browning Passage) at the mouth is 1.8 km^2. This drainage serves as a community watershed for Tofino.

Meares Creek flow estimates are based on Small Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Meares Creek Mean Monthly and Mean Annual Discharge (litres/second)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
326	297	229	184	86	61	31	36	58	236	362	356	194

3.2.5 Mercantile Creek Drainage

The estimated drainage area of Mercantile Creek where it flows into salt water (Ucluelet Inlet) at the mouth is 12.9 km^2. This drainage serves as a community watershed for Ucluelet.

Mercantile Creek flow estimates are based on Small Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Mercantile Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
2335	2129	1638	1316	619	439	219	258	413	1690	2593	2554	1393

3.2.6 Sharp Creek Drainage

The estimated drainage area of Sharp Creek where it flows into salt water (Lemmens Inlet) at the mouth is 2.4 km^2. This drainage serves as a community watershed for Tofino.

Sharp Creek flow estimates are based on Small Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Sharp Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
434	396	305	245	115	82	41	48	77	314	482	475	259

3.2.7 Tofino Creek Drainage

Water Survey of Canada has estimated the drainage area of Tofino Creek where it flows into salt water (Tofino Inlet) near the mouth as 38.6 km^2.

The hydrometric station on Tofino Creek has only recently been established, therefore, flow estimates for this report are based on Small Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Tofino Creek Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
6987	6369	4902	3937	1853	1312	656	772	1235	5057	7759	7643	4169

3.2.8 Upper Kennedy River Drainage

The estimated drainage area of Upper Kennedy River where it flows into the north end of Kennedy Lake is 217.9 km^2.

Upper Kennedy River flow estimates are based on Large Watershed-Discharge Runoff per Square Kilometre averages, noted in Appendix B. The mean monthly and mean annual discharge flow estimates are in the following table.

Upper Kennedy River Mean Monthly and Mean Annual Discharge (litres/second)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAD
35082	32249	22444	24405	26148	21572	11549	8062	10677	32685	39004	39222	24623

3.2.9 Other Drainages

Flow in other drainages not identified above may be calculated by multiplying the Larger, High or Smaller, Low Elevation Watershed-Discharge Runoff per Square Kilometre, noted in Appendix B, by the drainage area.

3.3 Lakes

The following table summarizes the available data for lakes within the Long Beach Water Allocation Plan area.

Lakes				
Lake	**Surface Area (ha)**	**Maximum Depth (m)**	**Mean Depth (m)**	**Volume (dam^3)**
Bedwell	68	120	-	-
Wanetta	10	33	12	1224
Kennedy	6040	150	33	2 011 320
Muriel	145	45	21	30 450
Clayoquot	45	45	-	-
Angora	31	46	19	5967

During the summer months approximately 0.3 m (1 ft) of water may be lost over the surface of a water body due to evaporation.

4.0 INSTREAM FLOW REQUIREMENTS

Maintaining the natural stream environment and instream uses are of paramount importance for present and future generations. Maintaining water for the fisheries resource is a key factor in maintaining instream flow requirements for water quality, wildlife, recreational, aesthetic and cultural values. Where instream flow for the fisheries resource is not a factor, economic and environmental concerns are to be considered. These considerations may be addressed on an individual basis based on water availability assessed against the natural 7-day average low flow for a 1 in 5 year recurrence interval.

The Ministry of Environment Provincial policy is:

> **Water allocations shall not be committed beyond the resource capability to replenish itself and maintain the natural amenities for present and future generations. Water allocations must be based upon reasonable expectations that water will be available for the period required without significantly impacting existing allocations or instream flow requirements.**
>
> **In situations where a water allocation decision will significantly impact instream uses of water, the comptroller or regional water manager may refuse the application or include water licence conditions to protect the instream use.**

Instream fisheries flow requirements are based on a Provincially modified version of the Tennant (Montana) Method. The following table outlines the modified version used within the Long Beach Water Allocation Plan area.

Modified Tennant (Montana) Method Instream Flow Requirements	
Flows	**Description**
30-60% MAD	Excellent spawning/rearing
20-30% MAD	Good spawning/rearing
10-20% MAD	Fair spawning/rearing
5-10% MAD	Poor spawning/rearing
>5% MAD	Severely degraded spawning/rearing

In drainages where fish are present the minimum flow required to sustain the fisheries resource for fair spawning and rearing habitat is 10% of the Mean Annual Discharge (MAD). The Regional policies to implement Provincial policy are:

> **The minimum flow required to sustain the fisheries resources for spawning and rearing is 10% of the Mean Annual Discharge (MAD)**

unless a more rigorous analysis indicates a different minimum flow requirement.

For streams where the natural mean monthly flow falls below 10% of the MAD, extractive licenced demands should only be allowed for the period of months when the mean monthly flow is above 60% of the MAD.

For streams where the mean 7-day average low flow falls below 10% of the MAD, extractive demands should only be allowed for the period of months when the mean monthly flow is above 60% of the MAD. Where the mean 7-day average low flow remains above 10%, then the 7-day low flow amount above 10% MAD is available.

Withdrawals from natural water bodies (lakes, ponds, swamps and marshes) supporting natural fisheries resources shall not reduce the shoal area more than 10%.

Within the Long Beach Water Allocation Plan area large, high elevation watersheds have mean monthly flows >20% MAD. Small, low elevation watersheds have monthly flows during the low flow period between 10% and 20% MAD. The 7-day average low flows are <10% MAD. Therefore, water may be available from large, high elevation watersheds throughout the year in varying monthly quantities, while small, low elevation watersheds are limited to the high flow period above 60% MAD, October through April.

Figure 4 illustrates fish habitat within the Long Beach Water Allocation Plan area.

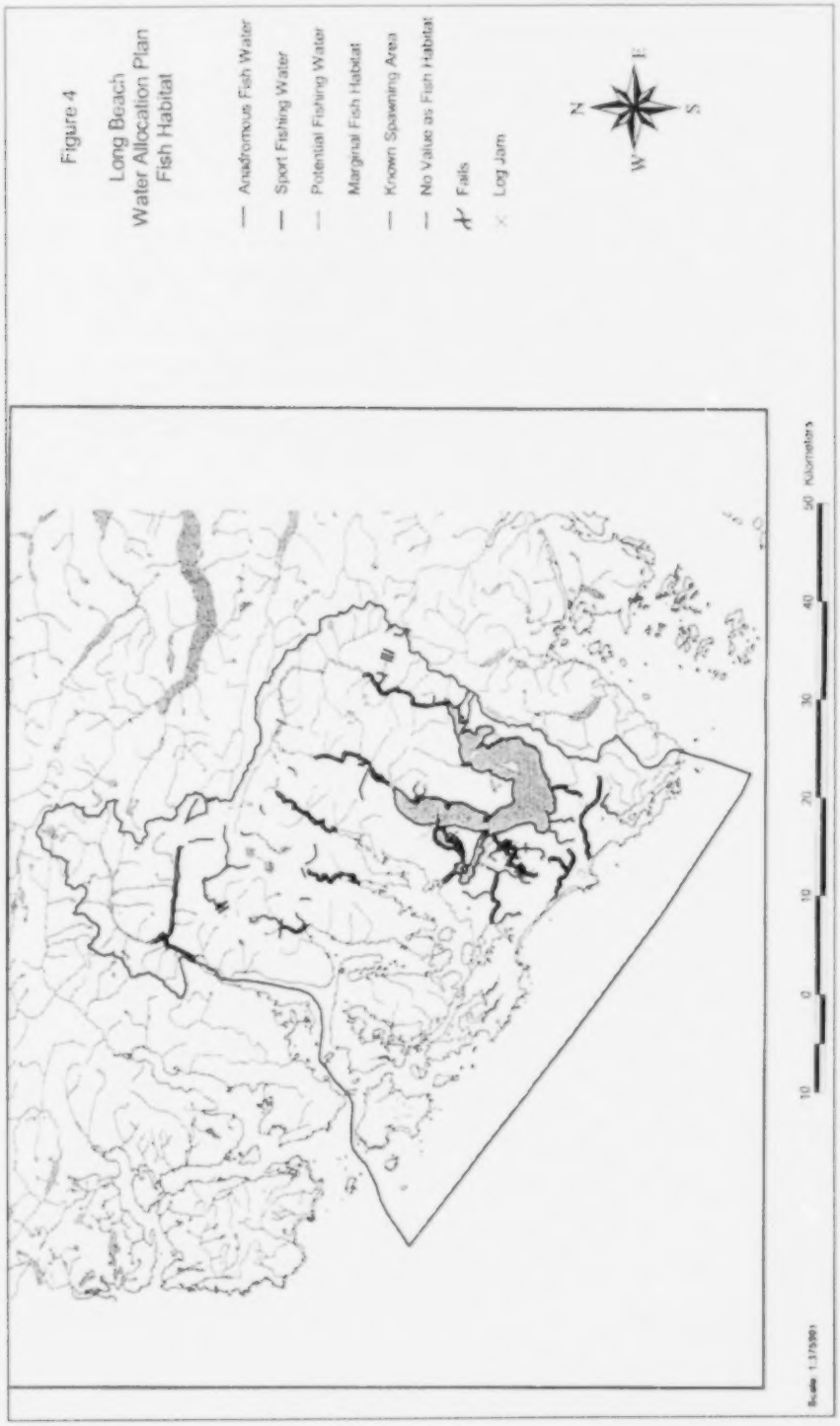


Figure 4: Fish Habitat

4.1 Bedwell River Instream Requirements

There are fish present in the Bedwell River drainage area.

Figure 5 illustrates that the estimated mean monthly flows in Bedwell River do not fall below 20% MAD (4746 l/s). This allows for extractive use of water throughout the year. The amount of water available in months where the discharge is above 60% MAD (14 238 l/s), October to June, is 353 238 dam^3. For months where the discharge is less than 60% MAD, July to September, the water that may be considered for licencing is the difference between the minimum mean monthly flow and 10% MAD. Water available from the low flow period is 42 900 dam^3. The estimated volume of water available for extractive demands, therefore, is 396 138 dam^3.

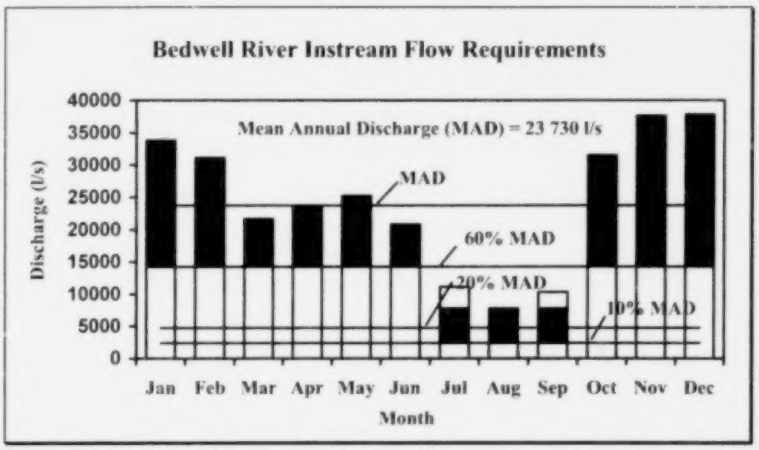


Figure 5: Bedwell River Instream Flow Requirements

4.2 Brother Creek Instream Requirements

There are fish present in the Brother Creek drainage area.

Figure 6 illustrates that the estimated mean monthly flows in Brother Creek are between 10% and 20% of the MAD for the months of July and August. However, the mean 7-day average low flow is below 10% MAD. The mean monthly flows are less than 60% MAD for May through September. Water is only available

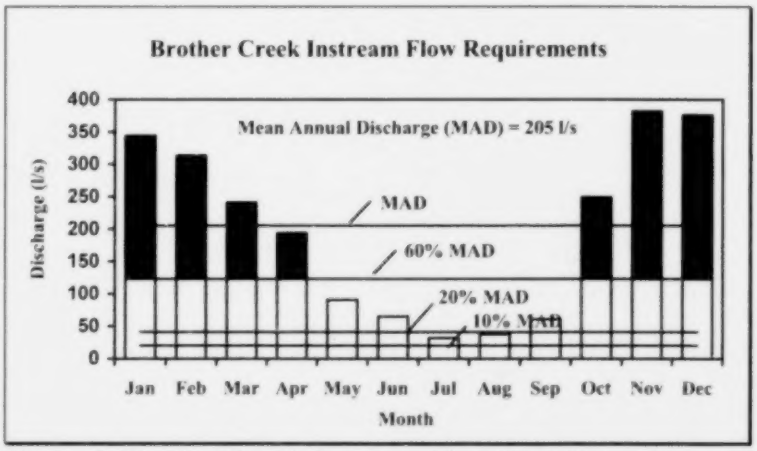


Figure 6: Brother Creek Instream Flow Requirements

for extractive use during months when the mean monthly discharge is greater than 60% MAD (123 l/s).

Therefore, no water is available for extractive demands during the May through September low flow period. Water is only available from Brother Creek during the months of October through April. The estimated volume of water available for this period is 3237 dam^3.

4.3 Itatsoo Creek Instream Requirements

There are fish present in the Itatsoo Creek drainage area.

Figure 7 illustrates that the estimated mean monthly flows in Itatsoo Creek are between 10% and 20% of the MAD for the months of July and August. However, the mean 7-day average low flow is below 10% MAD. The mean monthly flows are less than 60% MAD for May through September. Water is only available for extractive use during months when the mean monthly discharge is greater than 60% MAD (292 l/s).

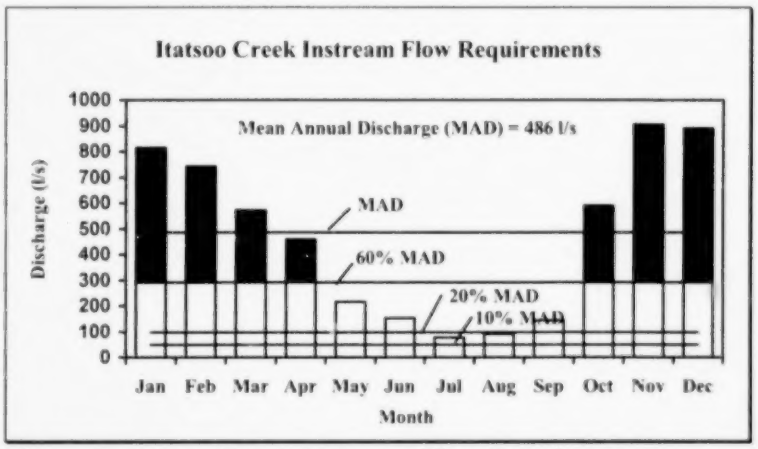


Figure 7: Itatsoo Creek Instream Flow Requirements

Therefore, no water is available for extractive demands during the May through September low flow period. Water is only available from Itatsoo Creek during the months of October through April. The estimated volume of water available for this period is 7667 dam^3.

4.4 Meares Creek Instream Requirements

There are fish present in the Meares Creek drainage area.

Figure 8 illustrates that the estimated mean monthly flows in Meares Creek are between 10% and 20% of the MAD for the months of July and August. However, the mean 7-day average low flow is below 10% MAD. The mean monthly flows are less than 60% MAD for May through September. Water is only available for extractive use during months when the mean monthly discharge is greater than 60% MAD (117 l/s).

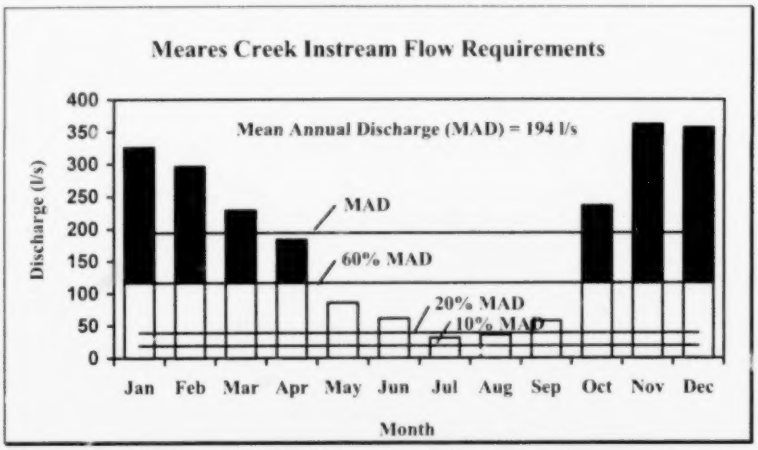


Figure 8: Meares Creek Instream Flow Requirements

Therefore, no water is available for extractive demands during the May through September low flow period. Water is only available from Meares Creek during the months of October through April. The estimated volume of water available for this period is 3067 dam^3.

4.5 Mercantile Creek Instream Requirements

There are fish present in the Mercantile Creek drainage area.

Figure 9 illustrates that the estimated mean monthly flows in Mercantile Creek are between 10% and 20% of the MAD for the months of July and August. However, the mean 7-day average low flow is below 10% MAD. The mean monthly flows are less than 60% MAD for May through September. Water is only available for extractive use during months when the mean monthly discharge is greater than 60% MAD (836 l/s).

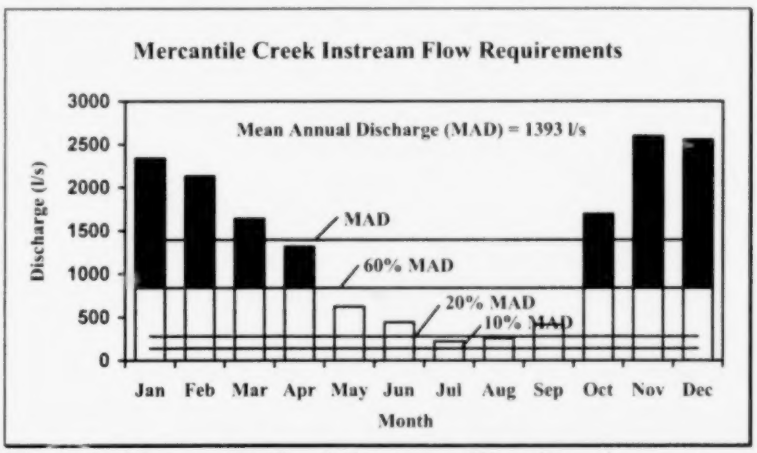


Figure 9: Mercantile Creek Instream Flow Requirements

Therefore, no water is available for extractive

demands during the May through September low flow period. Water is only available from Mercantile Creek during the months of October through April. The estimated volume of water available for this period is 21 978 dam^3.

4.6 Sharp Creek Instream Requirements

There are fish present in the Sharp Creek drainage area.

Figure 10 illustrates that the estimated mean monthly flows in Sharp Creek are between 10% and 20% of the MAD for the months of July and August. However, the mean 7-day average low flow is below 10% MAD. The mean monthly flows are less than 60% MAD for May through September. Water is only available for extractive use during months when the mean monthly discharge is greater than 60% MAD (156 l/s).

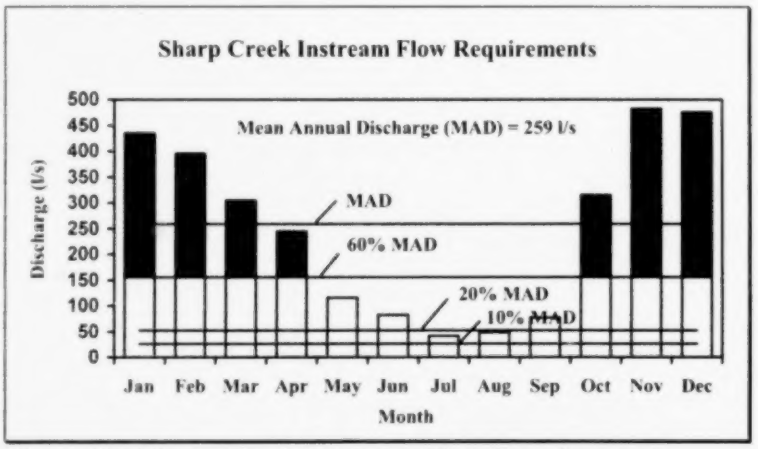


Figure 10: Sharp Creek Instream Flow Requirements

Therefore, no water is available for extractive demands during the May through September low flow period. Water is only available from Sharp Creek during the months of October through April. The estimated volume of water available for this period is 4089 dam^3.

4.7 Tofino Creek Instream Requirements

There are fish present in the Tofino Creek drainage area.

Figure 11 illustrates that the estimated mean monthly flows in Tofino Creek are between 10% and 20% of the MAD for the months of July and August. However, the mean 7-day average low flow is below 10% MAD. The mean monthly flows are less than 60% MAD for May through September. Water is only available for extractive use during months when the mean monthly discharge is greater than 60% MAD (2501 l/s).

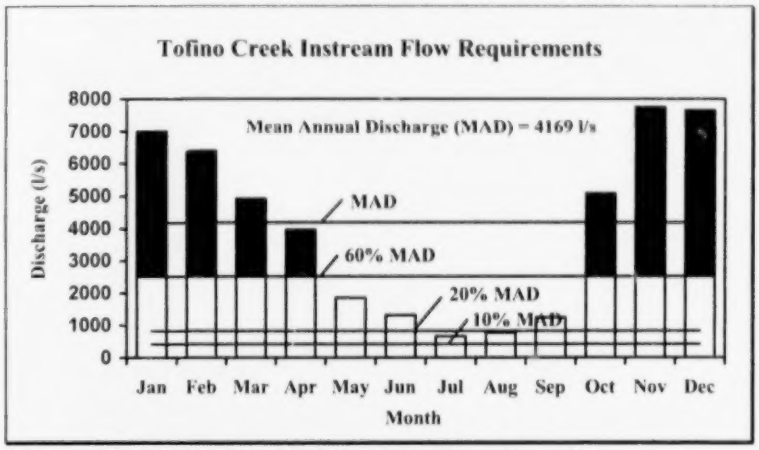


Figure 11: Tofino Creek Instream Flow Requirements

Therefore, no water is available for extractive demands during the May through September low flow period. Water is only available from Tofino Creek during the months of October through April. The estimated volume of water available for this period is 65 765 dam^3.

4.8 Upper Kennedy River Instream Requirements

There are fish present in the Upper Kennedy River drainage area.

Figure 12 illustrates that the estimated mean monthly flows in Upper Kennedy River do not fall below 20% MAD (4925 l/s). This allows for extractive use of water throughout the year. The amount of water available in months where the discharge is above 60% MAD (14 744 l/s), October to June, is 366 527 dam^3. For months where the discharge is less than 60% MAD, July to September, the water that may be considered for licencing is the difference between the minimum mean monthly flow and 10% MAD. Water available from this low flow period is 44 514 dam^3. The estimated volume of water available for extractive demands, therefore, is 411 040 dam^3.

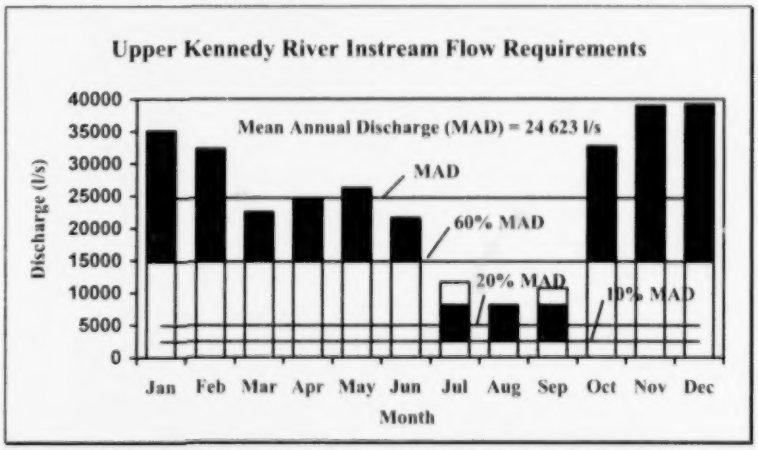


Figure 12: Upper Kennedy River Instream Flow Requirements

4.9 Other Drainages

Various other drainages not identified above may support fish populations. Where fish are identified, water will only be available from those drainages based upon hydrometric measurements or calculated as described in Appendix B.

5.0 WATER DEMAND

5.1 Licenced Demand

There are 28 water licences currently (September 1997) within the Long Beach Water Allocation Plan area. Figure 13 illustrates the number of water licences issued for each purpose for the water within the plan area. The largest number of water licences support waterworks demands (14 water licences) and domestic uses (6 water licences). There are 2 water licences for irrigation, 2 for storage, and 1 for conservation. The 3 licences for industrial purposes include 1 for ice making, 1 for ponds, and 1 for work camps.

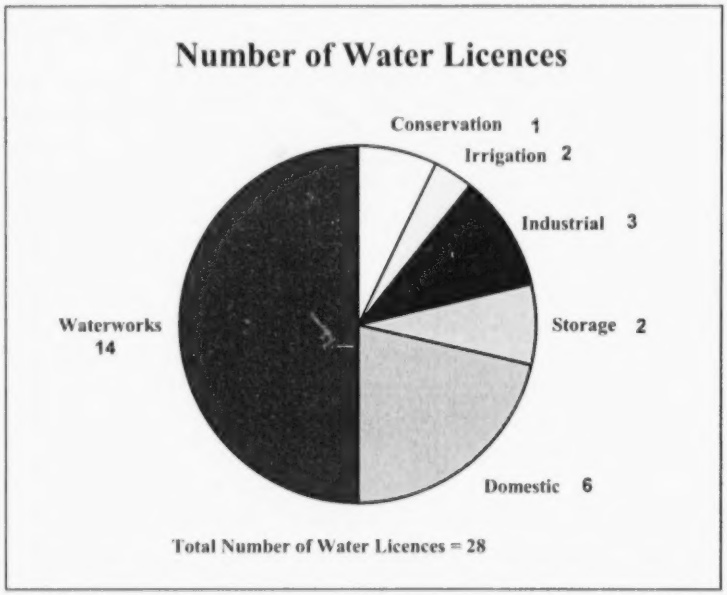


Figure 13: Number of Water Licences

Of greater significance is the estimated average annual licenced water demand and low flow water demand. The total estimated average annual licenced water demand for the plan area is 3872.17 dam^3. Figure 14 illustrates the estimated average annual licenced water demand for each purpose under which water licences have been issued within the plan area.

Conservation is the largest water demand (46%) in the plan area. Conservation is a non-consumptive water demand and does not significantly impact on instream flow requirements. The second

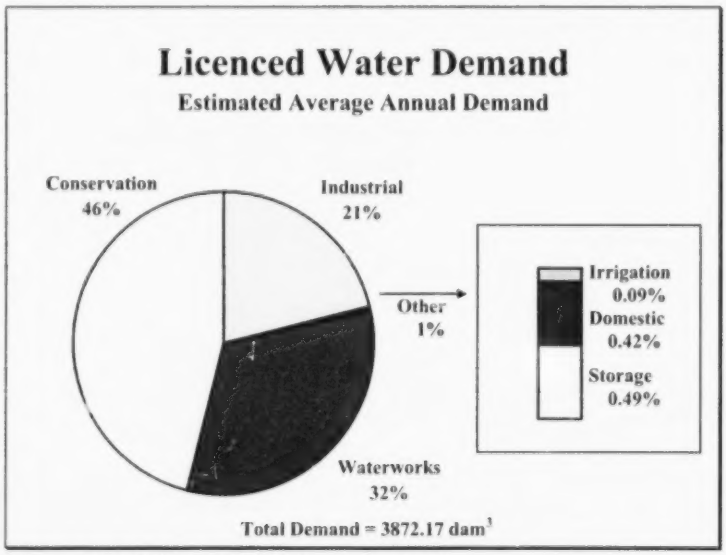


Figure 14: Licenced Water Demand

largest annual water demand is waterworks (32%) followed by industrial purpose demands (21%). The remaining 1% is storage (0.49%), domestic (0.42%), and irrigation (0.09%).

Annual licenced water demands within the Long Beach Water Allocation Plan area are detailed in Appendix D and summarized in the following table.

Estimated Average Annual Licenced Water Demand			
Purpose	**Number of Licences**	**Quantity Licenced**	**Annual Demand (dam^3)***
Conservation	1	2.00 cfs	1786.00
Domestic	6	8500.00 gpd	7.05
Industrial			
Ice Making	1	72 000.00 gpd	119.47
Ponds	1	0.77 cfs	687.61
Work Camps	1	5000.00 gpd	8.30
Irrigation	2	1.18 cfs	1.46
Storage	2	6.60 acft	8.14
Waterworks			
Local Authority	10	4097 325 000 gal/yr	1130.44
Other	4	149 100.00 gpd	123.70

* Assumes that domestic and waterworks are the authorized maximum daily licenced amount divided by 2 to estimate the average daily demand, then multiplied by 365.25 days to determine the annual demand. Industrial, storage, conservation, and irrigation represent total annual licenced volumes.

The low flow licenced water demand may be critical between competing water uses and instream flow requirements. The estimated low flow licenced demand for each identified drainage area and for other drainages in the Long Beach Water Allocation Plan area are summarized in Appendix E and the following table.

Low Flow Licenced (Consumptive) Water Demand per Drainage Area		
Significant Drainage Area	**Low Flow Water Demand***	
	litres/second	**dam^3**
Mercantile Creek	39.28	305.47
Sharp Creek	7.63	59.36
Meares and Close Creek	11.57	89.95
Brother Creek	1.87	14.57
Itatsoo Creek	0.18	1.43
Other Areas	0.08	0.61
Salt Water Drainages	44.32	344.57

* Based on an estimated licenced water demand assuming that: irrigation and industrial demands are totally withdrawn over the 90 day period; domestic and waterworks demand are the authorized licenced maximum daily for 90 days; storage balances demand, and therefore, is a negative demand over the 90 days; conservation and power are non-consumptive and, therefore, have no demand.

5.2 Projected Demand

There are 10 water licence applications pending as of September 1997. The potential annual water demand and the purposes of these existing applications are detailed in Appendix F and summarized in the following table.

Water Licence Applications			
Purpose	**Number of Licences**	**Quantity Licenced**	**Annual Demand (dam^3)***
Conservation	1	20.00 cfs	17 860.00
Domestic	2	1000.00 gpd	0.83
Industrial - Enterprise	2	5500.00 gpd	9.13
Land Improvement	1	0.40 acft	0.49
Power	1	1.00 cfs	893.00
Storage	1	6.00 acft	7.40
Waterworks	2	55 200 000 gal/yr	125.47

* Assumes that domestic and waterworks are the authorized maximum daily licenced amount divided by 2 to estimate the average daily demand, then multiplied by 365.25 days to determine the annual demand. Industrial, storage, power, and conservation represent total annual licenced volumes.

Future water demands are anticipated to be similar to existing licenced water demands. Waterworks, domestic, industrial, irrigation, and land improvement licences will increase in number as the population of the plan area expands. Conservation purpose demands will increase as conservation groups and fish agencies attempt to preserve and protect fish and wildlife habitat.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Long Beach Water Allocation Plan area is sparsely populated. Most people live in either small First Nation communities or in the towns of Ucluelet and Tofino.

Hydrometric watercourse flow information has been generalized for the west coast of Vancouver Island. Hydrometric stations to the northwest and southeast of the plan area were used along with stations within the plan area to calculate instream flow estimates. As more hydrometric stations are established, specific watercourse flow measurements will become available. Based upon current information, watercourse flow estimates have been extrapolated for the west coast extending over four water allocation plan areas. For larger, high elevation watersheds the low flow period occurs from July - September; for smaller, low elevation watersheds the low flow period occurs from May - September.

The flows in the larger, high elevation drainages do not fall below 20% MAD throughout the year. Water during the low flow period, therefore, may be available for extractive use, subject to licencing approval.

Smaller, low elevation drainages fall between 10% and 20% MAD during the low flow period. The 7-day average low flow falls below 10% MAD. Water during the low flow period, therefore, may not be available for extractive use.

Fisheries maps of the plan area show several drainages supporting fish and fish habitat. Although not all drainages show the presence of fish it is important to note that a watercourse could support fish and fish habitat now or in the future. Therefore, water extraction from these drainages during the low flow period may be limiting to instream fish habitat and fish production. The high flow periods, when water is greater than 60% MAD, have considerable amounts of water available for storage. In turn, this water can be used to meet a licencees demands during the low flow period.

Where instream flow for the fisheries resource is not a factor, economic and environmental concerns are to be considered. These considerations may be addressed on an individual basis based on water availability assessed using the natural 7-day average low flow for a 1 in 5 year recurrence interval.

The licenced water demand within the Long Beach Water Allocation Plan area consists of conservation, industrial, waterworks, irrigation, domestic and storage purposes.

The following table summarizes the water available for the identified significant drainage areas, exclusive of existing licenced water demand.

Long Beach Water Allocation Plan - Water Availability			
Drainages	**Drainage Area (km^2)**	**Water Volume Available (dam^3)**	
		High Flow Period*	**Low Flow Period****
Bedwell River	209.97	378 243	20 792
Brother Creek	1.86	3960	0
Itatsoo Creek	4.51	9634	0
Meares Creek	1.81	3866	0
Mercantile Creek	12.88	27 499	0
Sharp Creek	2.38	5089	0
Tofino Creek	38.60	82 387	0
Upper Kennedy River	217.90	392 515	21 581

*High Flow Period is the total volume of water available for storage and use above 60% MAD. Smaller, low elevation drainages the high flow period is from October-April. Larger, high elevation drainages have high flow periods from October-June.

**Low Flow Period is when the mean monthly discharge falls below 60% MAD. For smaller, low elevation drainages there is no water available during the low flow period, May-September. Larger, high elevation drainages have low flow periods from July-September. The total volume of water available for larger, high elevation drainages during the low flow period is the amount between 10% MAD and the minimum mean monthly flow above 20% MAD.

Fish and debris screens are part of good intake design and shall be required on all intake or diversion works within identified fish habitat areas. Fish passage provisions for both juvenile and adult fish will be required on all storage dams or diversion works constructed on sources frequented by fish. Appendix G contains information on fish

screening requirements. Instream works are to be constructed only during the period specified by the fisheries agencies to minimize impacts on fish resources.

6.1 Domestic

A domestic water licence shall be 2273 litres/day (500 gpd) for each rural dwelling as indicated on the plan attached to the water licence application. This amount will allow for the maintenance of 0.10 hectares (0.25 acres) of garden area associated with the dwelling. It is not appropriate, where the primary source of domestic water supply is insufficient, to issue additional water licences for the maintenance of green lawns and gardens.

Domestic water licences shall not be issued to provide evidence to subdivision approval authorities of an "adequate potable water supply" for subdivision development. Residential land subdivisions shall be encouraged to connect to existing community water supply systems.

To ensure an adequate domestic water supply for household uses, applicants should be prepared to develop storage or to use naturally stored water from lakes or marshes. For the average daily demand of !136.5 litres/day (250 gpd) for a four month period (June - September; 122 days) a volume of 0.139 dam^3 (4900 ft^3) is required. This requires a reservoir or dugout approximately 8 m (26 ft) long by 5.5 m (18 ft) wide, with an average depth of 3.5 m (11.5 ft), allowing 0.3 m (1 ft) for evaporation loss over the surface of the reservoir.

Dimple springs or springs that are not directly connected by a surface channel to a stream may not require supporting storage if the spring can supply at least 2273 litres/day (500 gpd) during the months of May through September. The applicant shall provide adequate pump tests and measurements during this period to determine the safe flow yield. Multiple domestic water licences on a spring will only be allowed if the applicant can provide assurances that adequate water is available by determining the safe flow yield near the end of the low flow period (i.e. pump test in August or September) and by satisfying any written concerns and objections of any existing water licencees. Springs with a surface channel connecting to a stream should be prepared to develop storage.

A water licence for domestic use shall not be issued to a residence within a community water supply area unless written leave to do so is obtained from the community water supply agency.

Measuring or regulating (i.e. metering) is not usually necessary with domestic water usage. An adequate screen shall be installed on the intake to prevent fish or debris from entering the works.

6.2 Waterworks

Waterworks purpose in the Water Act is the carriage or supply of water by a municipality, improvement district, regional district or private utility for the purpose of providing water to a residential area.

Applicants for a waterworks licence shall be required to assess the supply for a ten year projected demand and provide evidence that the projected demand is not excessive in comparison with adjoining community demands, that water conservation is being promoted (i.e. residential meters, pricing practices, education), and that adequate system balancing storage (i.e. volume difference between maximum hour and maximum daily demands) will be constructed or is available for peak hour demands.

Water utilities, pursuant to the Water Utilities Act, will also have to provide evidence that the appropriate requirements for a Certificate of Public Convenience and Necessity (CPCN) have been met and a CPCN will be obtained.

Licenced allocations will be limited to a 10 year projected demand except where the applicant can provide satisfactory evidence that a longer projection period is required (i.e. because the cost of construction of works must be amortized over a period).

The licencee shall be required to meter and record the water diverted from the source stream.

The licencee shall be required to treat the water supply in accordance with the Ministry of Health requirements.

Waterworks licences in smaller, low elevation drainages will require storage to support demand. Waterworks licences in larger, high elevations drainages may not require storage to support demand.

Storage and diversion structures must be capable of maintaining or improving existing low flows during the low flow period and maintaining fish passage where required.

6.3 Irrigation

The soil type, crop rooting depth, and climatic characteristics determine the water requirements for irrigation. The irrigation demands for different crops and their rooting depths along with the water availability coefficient are classified into two categories, shallow (0.5 m) and deep (1.0 m) effective rooting depths. The available water storage capacity (AWSC) can be estimated for shallow and deep root zone depth for the soil types present within the plan area.

If the applicant for a water licence can provide more specific soil assessment and irrigation requirement information for a given area, that soil assessment and irrigation requirement may be used to assess irrigation demands.

Irrigation gun or flood irrigation systems may require greater irrigation quantities and should be discouraged. In the case where irrigation gun or flood irrigation practices are to be used suitable meters shall be installed and water withdrawals limited to the equivalent annual irrigation requirements for sprinkler systems. As the equivalent annual irrigation water requirements for sprinkler systems may not be adequate to sustain crops using these less efficient methods of irrigation, the applicant may be required to reduce crops, limit the acreage irrigated or convert to a more efficient irrigation system. Trickle irrigation can reduce water requirements by 35% and should be encouraged where practical.

Irrigation water demands in smaller, low elevation drainages must be supported by off-stream storage development. Storage required to support irrigation demands is the total required amount as per crop and soils, plus an additional allowance for evaporation and other losses from the storage reservoir. Diversion into storage will be authorized for the period that the mean monthly flows are above 60% MAD. Irrigation water demands in larger, high elevation drainages may not require storage to support demand.

The maximum allowable rate of withdrawal shall not exceed 47.2 litres per minute per hectare (4.2 imperial gallons per minute per acre) of land to be irrigated. Irrigators are encouraged to employ good agricultural practices (field size, system selection and farm management) to conserve water. The authorized period of use for irrigation shall be from April 1 to September 30.

As noted above, all intake works in fish bearing waters shall be screened to prevent fish and debris from entering the intake.

6.4 Industrial

Industrial water licences and water licence applications within the plan area are demands associated with ice making, ponds, work camps, and enterprise.

Commercial fish hatcheries and/or rearing purposes shall require an industrial water licence. Use of water by government and non-profit organizations will be licenced as conservation purpose. Information on fish species and size, water temperature requirements, and operating methods will be required in support of an application for water licence. Fish Farm and Waste Management Permits will also be required. Offstream storage is required for fish ponds associated with commercial fish farming.

Golf course watering is essentially an irrigation water demand except that the watering is not limited to the irrigation period of April to September. The quantity of water required should be determined as previously stated in the irrigation section. Except for the period of water withdrawal, which shall be the whole year, the same requirements and conditions as irrigation demands shall apply. Water demands in smaller, low elevation drainages will require offstream storage. Water demands in larger, high elevation

drainages may not require offstream storage. Diversion into storage will be authorized for the period that the mean monthly flows are above 60% MAD.

Cattle or livestock watering requiring more than 450 litres/day (100 gpd) are to be considered an Industrial (Agricultural/Stockwatering) demand. Cattle or livestock requiring 450 litres/day (100 gpd) or less will be considered a Domestic (Livestock) demand. Estimated amounts of water required for livestock watering demands are listed in the following table.

Recommended Livestock Water Requirements		
Livestock	**Water Requirements**	
	litres/day	**gallons/day**
Cattle (beef) per animal	45	10
Cattle (dairy) per animal	132	29
Chickens per 100 animals	27	6
Turkeys per 100 animals	55	12

Industrial demands related to commercial and resort development should be handled similar to multiple domestic demands with the same requirements.

6.5 Storage

Storage purpose is the impoundment of water, either onstream or offstream in a dugout or behind a dam. In the event that a large storage development to support a major water demand (i.e. hydro power, pulp and paper, community works) is proposed a more specific supply versus demand and environmental impact assessment will be required.

The storage quantity required to support the smaller water demands of domestic, industrial and irrigation uses shall be the low flow period volume of the water demand plus an additional allowance of 0.3 m (1 ft) depth over the surface area of the storage reservoir for evaporation and other losses. Offstream storage in a dugout will be required for these demands in most cases. Storage in swamps or natural depressions may be considered where fish and wildlife are not adversely impacted or where the natural habitat is enhanced.

The water licence applicant will be required to complete an adequate report form entitled "Schedule 2 - Dam & Reservoir Information". If the required report is not provided the application will be refused.

Diversion of water into offstream storage in smaller, low elevation drainages will be during the high flow period. Provision to maintain flows during the low flow period shall be required for instream storage reservoirs.

Water demands in larger high elevation drainages may not require storage to support demand.

The applicant must obtain written agreement, a right of way or an easement for works or flooding of other lands.

Fish passage is required, for both juvenile and adult fish, at all dams in fish bearing streams. Design of storage dams must consider fish ladders and provide adequate flow release to maintain fish passage where required. Loss of spawning areas and modification of fish habitat due to storage development may require mitigation work in the affected stream.

Design plans must be submitted and accepted in writing before construction commences on any proposed dam over 3 m (10 ft) in height or on storage 12 dam^3 (10 acft) or more in volume.

All water licencees that develop storage greater than 100 dam^3 (80 acft) shall be required to record and report the water level of the reservoir and flows from the reservoir as directed by the "Engineer" as defined in the Water Act of BC.

6.6 Land Improvement

Land improvement purpose is the diversion of water to improve drainage, to protect from flooding, to prevent erosion, or to divert and use water for aesthetic purposes. No significant water quantity is removed from the stream. Land improvement water demands are non-consumptive uses of the water resources.

Water used to facilitate the development of park is usually maintained in a dammed lake for recreation (i.e. boating, fishing, swimming, golf course water traps) and aesthetics. The dammed lake is usually filled during the high flow period and the water levels maintained or gradually lowered during the low flow period. Golf courses also require water licences to construct and maintain dugouts or to control the volume of water in small ponds for water traps and aesthetics. Property owners may acquire a water licence to construct and maintain dugouts or to control the volume of small ponds for aesthetics. These water demands are essentially storage developments that do not support an extractive use. Therefore, all the requirements noted for storage development shall be required for land improvement development where applicable. The water quantity required to facilitate the development of a park or to create an aesthetic pond shall be the volume of the impoundment.

Constructing ditches to drain swamps or marshes, confining or straightening the meandering of stream channels, and relocating a stream channel adjacent to a property line is sometimes proposed to accommodate subdivision or building development. Streams should be maintained as near as possible to pre-development flow conditions. The development of land improvement detention dugouts or the control of water in

natural ponds, swamps, and marshes to reduce flood flow and increase low flow releases will be encouraged. Proposed construction of works on streams that drain swamps or marshes or increase high flow conditions and reduce low flow conditions will not be authorized.

6.7 Conservation

Conservation purpose is the use and storage of water or the construction of works in and about a stream for the enhancement of fish or wildlife for non-profit purposes.

Salmon enhancement proposals that would significantly increase fish stocks in stream channels may require the development of supporting storage to maintain required low flows.

6.8 Power

The water licence applicant will be required to complete "Schedule 2-Dam & Reservoir Information" and "Schedule 3-Power Information" reports. If the required reports are not provided the application will be refused.

In the event that a large power development is proposed a more specific supply versus demand and environmental impact assessment will be required. For a small power development the following assessments shall be used to determine the required water demand.

Flow requirements for power:

$$Q = \frac{P}{h * e * k}$$

Q = volume rate of flow (m^3/s)
P = power required at the generator (kW)
h = gross head from the pipeline intake to the tailwater (m)
e = total efficiency of the plant considering head loss in the penstock, pipeline, turbine and generator expressed by a decimal (use 0.65 for pumps, 0.70 for turbines)
k = specific gravity constant (9.81 m/s^2)

Electric Load Requirements	
Type of Establishment	**Maximum Electrical Demand per Residence (kW)**
Cabin	4
Single Family Residence:	
Lighting and appliances	6
Lighting, appliances, and water heating	10
Lighting, appliances, water, and space heating	26
Hotel or Motel	0.16 per m^2
Camp:	
Combined space heating electric and propane	1.5
All electric space heating	2

Water returned to the stream after generation of hydro power may be licenced for subsequent compatible water demands. Hydro power use that diverts water away from subsequent use should be discouraged.

Fish passage is required, for both juvenile and adult fish, at all power diversion works in fish bearing streams. Fish and debris screens may be required at both intake and outlet works to ensure that fish are not lost due to operation of the power plant. Loss of spawning areas and modification of fish habitat due to power development may require mitigation work in the affected stream.

6.9 Allocation Plan Revision

The Long Beach Water Allocation Plan should be reviewed and updated on or before January 1, 2003.

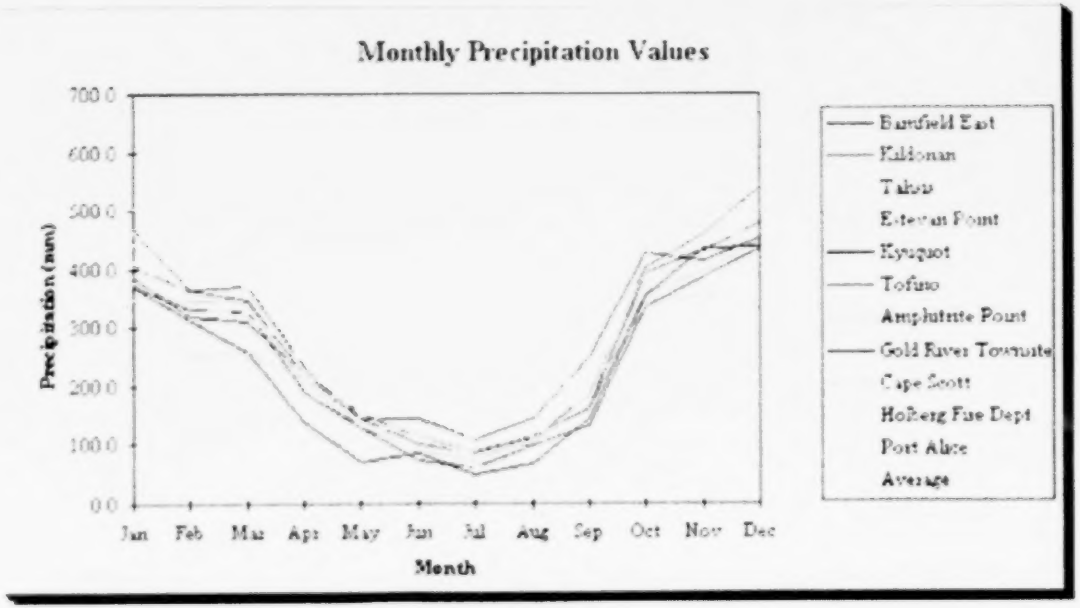
APPENDIX A: Atmospheric Environment Service

Climatic Normals

(Under separate cover)

Precipitation Averages (mm)

Station Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Bamfield East	372.2	330.5	328.7	191.5	129.1	74.7	62.1	98.3	133.2	334.4	387.1	437.0	2878.8
Kildonan	468.7	365.5	347.8	220.4	152.9	111.4	93.4	106.0	187.3	403.1	459.5	539.1	3455.1
Tahsis	464.0	406.0	350.8	254.7	142.1	119.6	91.0	114.5	269.9	482.4	513.4	620.4	3828.8
Estevan Point	376.9	337.4	321.7	220.4	129.3	113.2	87.7	103.5	183.1	373.9	426.3	446.5	3119.9
Kyuquot	386.1	318.4	309.6	220.3	144.6	143.7	108.5	143.2	249.8	426.7	413.1	454.5	3318.5
Tofino	404.3	366.4	372.4	233.8	143.0	101.7	86.1	114.1	163.2	391.8	432.3	479.2	3288.3
Amphitrite Point	407.5	347.3	342.8	204.3	130.0	92.1	72.6	113.1	161.0	359.1	395.8	451.7	3077.3
Gold River Townsite	371.0	312.4	256.9	136.7	69.3	85.2	48.8	68.1	144.8	354.5	434.9	438.1	2720.7
Cape Scott	348.1	254.5	259.4	211.4	154.5	120.6	82.9	100.2	187.2	334.3	360.6	335.6	2749.1
Holberg Fire Dept.	504.1	386.5	372.4	315.6	195.9	165.5	105.3	123.8	264.1	463.7	545	514.5	3956.5
Port Alice	441	358.8	334.9	238.3	137.2	89.1	62.8	82.5	192	421.1	502.7	485.3	3345.7
Average	**413.1**	**344.0**	**327.0**	**222.5**	**138.9**	**110.6**	**81.9**	**106.1**	**194.1**	**395.0**	**442.8**	**472.9**	**3249.0**



BAMFIELD EAST

Location: 48° 50'N 125° 7'W

Elevation: 4 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	4.0	5.6	5.8	7.5	9.9	12.2	14.0	14.3	13.2	10.3	6.8	5.0	9.1
Rainfall (mm)	360.0	329.0	326.4	191.5	129.1	74.7	62.1	98.3	133.2	334.4	386.3	428.7	2853.7
Snowfall (cm)	12.2	1.5	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	8.4	25.2
Total Precipitation (mm)	372.2	330.5	328.7	191.5	129.1	74.7	62.1	98.3	133.2	334.4	387.1	437.0	2878.8
Days with:													
Measurable Rainfall	20	19	19	17	14	10	8	10	11	18	21	22	189
Measurable Snowfall	3	< 0.5	1	0	0	0	0	0	0	0	< 0.5	2	6
Measurable Precipitation	21	19	20	17	14	10	8	10	11	18	22	23	193

KILDONAN

Location: 49° 0'N 125° 0'W

Elevation: 3 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)													
Rainfall (mm)	445.6	361.7	342.1	219.6	152.9	111.4	93.4	106.0	187.3	403.1	458.6	526.8	3408.5
Snowfall (cm)	28.3	6.9	8.5	0.1	0.0	0.0	0.0	0.1	0.0	0.2	1.9	21.6	67.6
Total Precipitation (mm)	468.7	365.5	347.8	220.4	152.9	111.4	93.4	106.0	187.3	403.1	459.5	539.1	3455.1
Days with:													
Measurable Rainfall	18	17	18	17	14	13	9	10	11	17	20	20	184
Measurable Snowfall	3	1	1	0	0	0	0	0	0	0	0	2	7
Measurable Precipitation	21	18	18	17	14	13	9	10	11	17	20	21	189

TAHSIS

Location: 49° 55'N 126° 39'W
Elevation: 5 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)													
Rainfall (mm)	436.1	396.4	341.2	252.4	142.1	119.6	91.0	114.5	269.9	482.4	509.1	605.0	3759.7
Snowfall (cm)	27.9	9.6	9.6	2.3	0.0	0.0	0.0	0.0	0.0	0.0	4.2	15.4	69.0
Total Precipitation (mm)	464.0	406.0	350.8	254.7	142.1	119.6	91.0	114.5	269.9	482.4	513.4	620.4	3828.8
Days with:													
Measurable Rainfall	18	18	19	17	13	12	9	11	13	19	21	21	191
Measurable Snowfall	4	2	3	1	0	0	0	0	0	0	1	2	13
Measurable Precipitation	21	18	19	17	13	12	9	11	13	19	21	22	195

GOLD RIVER TOWNSITE

Location: 49° 47'N 126° 3'W
Elevation: 117 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	0.3	3.0	4.5	7.7	11.5	14.6	17.2	17.4	14.4	9.5	4.3	1.5	8.8
Rainfall (mm)	295.6	262.9	228.2	119.0	67.5	67.9	48.0	71.2	149.5	379.5	381.6	423.9	2494.8
Snowfall (cm)	78.3	25.5	22.5	0.1	0.0	0.0	0.0	0.0	0.0	0.2	8.5	28.9	164.0
Total Precipitation (mm)	371.0	312.4	256.9	136.7	69.3	85.2	48.8	68.1	144.8	354.5	434.9	438.1	2720.7
Days with:													
Measurable Rainfall	15	17	18	16	14	12	8	11	12	19	19	21	182
Measurable Snowfall	8	5	4	0	0	0	0	0	0	0	2	4	23
Measurable Precipitation	20	17	19	16	15	12	9	11	13	19	20	23	194

ESTEVAN POINT

Location: 49° 23'N 126° 33'W
Elevation: 7 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	4.5	5.5	5.5	7.4	9.9	12.1	13.7	14.1	13.0	10.2	7.2	5.6	9.1
Rainfall (mm)	359.0	329.5	313.7	216.9	129.2	113.2	87.7	103.5	183.1	373.9	422.7	434.3	3066.7
Snowfall (cm)	16.3	6.2	6.2	2.8	0.1	0.0	0.0	0.0	0.0	0.1	3.5	9.6	44.8
Total Precipitation (mm)	376.9	337.4	321.7	220.4	129.3	113.2	87.7	103.5	183.1	373.9	426.3	446.5	3119.9
Days with:													
Measurable Rainfall	22	19	20	18	14	12	10	11	13	20	22	24	205
Measurable Snowfall	4	2	2	1	< 0.5	0	0	0	0	< 0.5	1	3	13
Measurable Precipitation	23	19	21	18	14	12	10	11	13	20	22	24	207

KYUQUOT

Location: 50° 2'N 127° 22'W
Elevation: 3 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)													
Rainfall (mm)	367.0	315.4	304.4	218.3	144.6	143.7	108.5	143.2	249.8	427.2	411.2	443.8	3277.1
Snowfall (cm)	16.7	3.7	5.2	2.1	0.0	0.0	0.0	0.0	0.0	0.0	1.7	10.5	39.9
Total Precipitation (mm)	386.1	318.4	309.6	220.3	144.6	143.7	108.5	143.2	249.8	426.7	413.1	454.5	3318.5
Days with:													
Measurable Rainfall	21	20	21	20	17	14	12	12	16	21	23	23	220
Measurable Snowfall	5	1	2	1	0	0	0	0	0	0	1	3	13
Measurable Precipitation	24	20	22	20	17	14	12	12	16	21	23	25	226

TOFINO

Location: 49° 5'N 125° 46'W
Elevation: 20 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	3.8	5.3	5.5	7.2	9.9	12.4	14.2	14.4	13.1	9.9	6.6	4.9	8.9
Rainfall (mm)	382.7	357.3	361.2	231.4	143.0	101.7	86.1	114.1	163.2	391.8	429.3	464.2	3226.0
Snowfall (cm)	20.5	6.0	8.6	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	13.2	53.0
Total Precipitation (mm)	404.3	366.4	372.4	233.8	143.0	101.7	86.1	114.1	163.2	391.8	432.3	479.2	3288.3
Days with:													
Measurable Rainfall	20	18	19	18	13	11	9	11	13	19	22	22	195
Measurable Snowfall	4	2	2	1	0	0	0	0	0	0	1	3	13
Measurable Precipitation	21	19	20	18	13	11	9	11	13	19	22	23	199

AMPHITRITE POINT

Location: 48° 55'N 125° 32'W
Elevation: 11 m

Precipitation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	4.7	6.1	6.2	8.0	10.4	12.4	13.9	14.3	13.4	10.6	7.4	5.5	9.4
Rainfall (mm)	393.1	344.2	338.1	203.5	130.0	92.1	72.6	113.1	161.0	359.1	393.6	440.3	3040.7
Snowfall (cm)	14.5	3.1	4.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	2.2	11.4	36.5
Total Precipitation (mm)	407.5	347.3	342.8	204.3	130.0	92.1	72.6	113.1	161.0	359.1	395.8	451.7	3077.3
Days with:													
Measurable Rainfall	20	19	19	17	14	11	9	12	12	19	21	22	195
Measurable Snowfall	2	1	1	< 0.5	0	0	0	0	0	0	< 0.5	2	6
Measurable Precipitation	21	19	19	17	14	11	9	12	12	19	21	23	197

CAPE SCOTT
Location: 50° 47'N 128° 26'W
Elevation: 70m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	4.5	5.1	5.9	7	9.2	11.3	13.1	13.7	12.5	9.8	6.9	4.8	8.6
Rainfall (mm)	327.3	242.8	248.7	206.5	154.4	120.6	82.6	100.2	187.2	334	356.1	323	2683.4
Snowfall (cm)	20.5	11.4	10.6	4.8	0.0T	0	0	0	0.0T	0.3	4.6	12.6	64.8
Total Precipitation (mm)	348.1	254.5	259.4	211.4	154.5	120.6	82.9	100.2	187.2	334.3	360.6	335.6	2749.1
Days with:													
Measurable Rainfall	23	20	23	20	19	17	16	17	17	24	24	24	245
Measurable Snowfall	6	3	3	2	*	0	0	0	0	*	2	4	21
Measurable Precipitation	25	21	23	20	19	17	16	17	17	24	24	25	250

HOLBERG FIRE DEPT
Location: 50° 39'N 127° 59'W
Elevation: 46m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	3.2	4.2	5.6	7.1	9.9	12.2	14.5	15	13.2	9.7	5.5	3.5	8.6
Rainfall (mm)	471.2	366.6	358.6	311.7	195.9	165.5	105.3	123.8	264.1	463.7	536.9	492.5	3855.9
Snowfall (cm)	32.9	20	13.9	3.9	0	0	0	0	0	0	8.1	21.1	99.8
Total Precipitation (mm)	504.1	386.5	372.4	315.6	195.9	165.5	105.3	123.8	264.1	463.7	545	514.5	3956.5
Days with:													
Measurable Rainfall	22	19	23	22	20	18	13	14	16	22	24	23	234
Measurable Snowfall	6	5	4	1	0	0	0	0	0	0	2	4	22
Measurable Precipitation	25	20	24	22	20	18	13	14	16	22	24	25	242

PORT ALICE
Location: 50° 23'N 127° 27'W
Elevation: 21m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Temperature (°C)	3.7	4.9	6	7.6	10.8	13.5	15.9	16.1	13.7	10	6.2	N	N
Rainfall (mm)	421.3	350.4	328.5	237.6	137.2	89.1	62.8	82.5	192	421	499.5	474.6	3296.5
Snowfall (cm)	22.5	8.2	5.9	0.6	0	0	0	0	0	0.1	3	10.9	51.4
Total Precipitation (mm)	441	358.8	334.9	238.3	137.2	89.1	62.8	82.5	192	421.1	502.7	485.3	3345.7
Days with:													
Measurable Rainfall	20	18	21	18	16	14	9	12	13	21	22	20	204
Measurable Snowfall	3	2	1	*	0	0	0	0	0	*	*	2	10
Measurable Precipitation	22	19	21	18	16	14	9	12	13	21	22	21	207

APPENDIX B

Hydrometric Estimation Methodology

West Coast of Vancouver Island

The west coast of Vancouver Island, from an area southeast of Alberni Inlet stretching northwest to Cape Scott, has similar physiographic characteristics such as slope, aspect, and surface water storage. With similar precipitation, evapotranspiration, infiltration, and vegetation characteristics, the nature of watershed dynamics can be generalized to include four water allocation plan areas. These include the Alberni Inlet, Long Beach, Gold-Tahsis-Zeballos, and Quatsino Sound plans.

The monthly hydrologic regime, however, between smaller, low elevation and larger, high elevation watersheds vary throughout the year. Generally, watersheds less than 100 km^2 are considered smaller and those more than 100 km^2 are considered larger. As well, watersheds of high elevation generally accumulate a snowpack, while low elevation watersheds may not have a snowpack. It is important to note that in some cases a watershed may be considered large in size, but, due to its topography, low in elevation or vice versa. In cases such as these, a more rigorous analysis of the watershed may need to be undertaken to determine the appropriate hydrologic regime.

The following tables, while sharing similar Mean Annual Discharges (MAD) demonstrate variations in Mean Monthly Discharges (MMD). The appropriate table, depending on a watersheds size and relative elevation, should be used in estimating watercourse flows. In order to calculate monthly and yearly flow estimates the watershed size is multiplied by the averages for each MMD or the MAD average.

Small, Low Elevation Watershed - Discharge Runoff per Square Kilometre (litres/second/km^2)													
WSC Station	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**MAD**
08HB048 (Carnation)	149	144	99	69	38	25	13	15	19	83	169	155	81
08HB014 (Sarita)	216	203	144	116	60	38	20	18	35	143	224	240	121
08HF006 (San Josef)	178	149	138	122	45	38	18	27	42	168	209	200	121
Average	181	165	127	102	48	34	17	20	32	131	201	198	108
% of MAD	168	153	118	94	44	31	16	19	30	121	186	183	100

Large, High Elevation Watershed - Discharge Runoff per Square Kilometre (litres/second/km^2)													
WSC Station	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**MAD**
08HC001 (Gold)	116	93	76	84	97	79	38	19	32	109	137	133	82
08HE006 (Zeballos)	212	173	126	122	117	104	71	51	93	201	236	217	143
08HC002 (Ucona)	124	109	83	89	110	106	63	34	42	113	148	142	95
08HB012 (Nahmint)	206	204	138	128	156	119	54	28	60	242	207	233	148
08HE003 (Benson)	114	124	110	96	92	71	37	19	30	103	116	181	87
08HC004 (Bedwell)	191	186	84	153	146	116	55	68	36	132	232	173	125
Average	161	148	103	112	120	99	53	37	49	150	179	180	113
% of MAD	142	131	91	99	106	88	47	33	43	133	158	159	100

Methodology

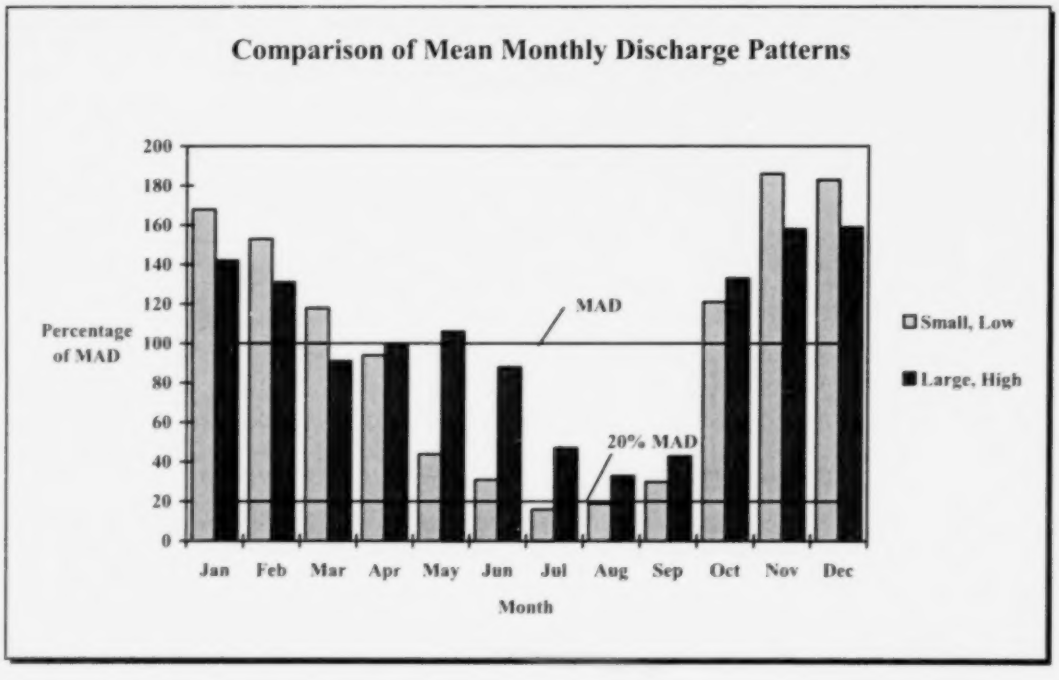
There are a number of Water Survey of Canada (WSC) hydrometric stations located on the west coast of Vancouver Island with varying years of operation. Stations with natural flows and in operation throughout the year for several years were selected to establish hydrologic averages on the west coast. The following table identifies WSC stations by name, number, the years of operation, and the size of the watershed, which were used for flow estimate calculations in this report.

Water Survey of Canada Hydrometric Stations			
Station Name	**Station Number**	**Watershed Size (km^2)**	**Operation Period Used in Methodology**
San Josef River below Sharp Creek	08HF006	64.5	1990, 1993-1996
Carnation Creek at the Mouth	08HB048	10.1	1972-1996
Sarita River near Bamfield	08HB014	162.0	1948-1996
Ucona River at the Mouth	08HC002	185.0	1957-1996
Gold River below Ucona River	08HC001	1010.0	1956-1996
Nahmint River near Port Alberni	08HB012	140.0	1924-1931
Benson River near Port Alice	08HE003	228.0	1925-1931
Zeballos River near Zeballos	08HE006	181.0	1960-1996
Bedwell River above Ursus Creek	08HC004	114.0	1990-1996

A small difference between the MADs was calculated between small, low elevation and large, high elevation drainage basins. The significant difference between these two

drainage types lies in the mean monthly flows throughout the year represented as percentages of MAD. These values are shown in the following table and graph.

Percentage of MAD												
Drainages	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Small, Low Elevation	168	153	118	94	44	31	16	19	30	121	186	183
Large, High Elevation	142	131	91	99	106	88	47	33	43	133	158	159



The variation between the monthly flows justifies the need for addressing individual watersheds relative to their size and elevation. Refer to the tables at the beginning of this section to estimate mean monthly and annual discharges for either of the watershed types. For detailed summarizations of WSC hydrometric stations refer to Appendix C.

Hydrometric information used in this report is based upon data available at the time of writing. A number of provincial hydrometric stations are planned to be in operation within the next few years. Data from these stations will compliment the existing data.

Low Flows

Watercourses where the minimum monthly discharges are above 20% MAD may allow for extractive use of water throughout the year. During the high flow period water above 60% MAD may be available, however, when discharges fall below 60% MAD the water that may be available for use is the difference between 10% MAD and the least mean monthly flow during the low flow period.

If there are fisheries concerns Regional Policy dictates that drainages with monthly flows between 10% and 20% MAD must refer to 7-day average low flows to determine water availability. The 7-day average low flow data for small, low elevation hydrometric stations on the west coast of Vancouver Island are less than 10% MAD. Therefore, water available for extractive use in small, low elevation watersheds are limited to months where the discharge is above 60% MAD.

In watersheds were there are no fisheries concerns then a natural 7-day average low flow for a recurrence interval of 1 in 5 years is used to assess water supplies available from streams.

APPENDIX C: Water Survey of Canada Hydrometric Stations

(Under separate cover)

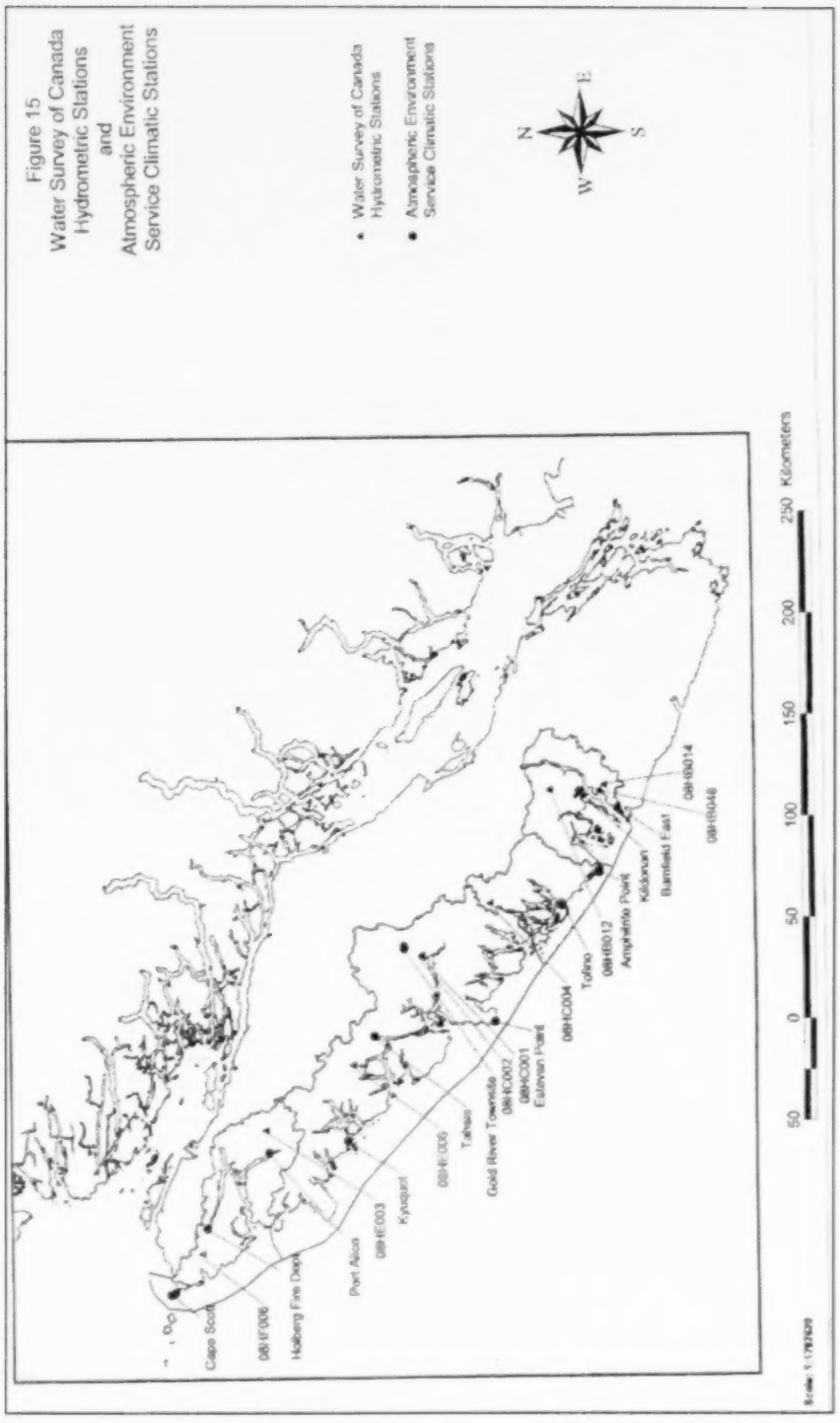


Figure 15: Water Survey of Canada Hydrometric Stations and Atmospheric Environment Service Climatic Stations

Station Name: CARNATION CREEK AT THE MOUTH
Station Number: 08HB048
Natural or Regulated: N
Drainage Area (sq.km.): 10.10
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	48	54	56
Longitude	124	59	52

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1972												2.34	
1973	2.03	0.74	0.97	0.29	0.50	0.46	0.07	0.03	0.03	0.86	1.62	2.53	0.85
1974	2.10	2.09	2.41	1.11	0.73	0.37	0.27	0.08	0.09	0.26	1.89	1.97	1.11
1975	1.22	0.71	0.91	0.43	0.51	0.23	0.11	0.62	0.14	2.31	3.14	2.24	1.05
1976	1.68	1.51	1.24	0.55	0.50	0.30	0.19	0.17	0.24	0.49	0.60	1.50	0.75
1977	0.73	1.56	1.16	0.46	0.37	0.19	0.11	0.12	0.19	0.89	1.80	1.22	0.73
1978	0.72	0.74	0.83	0.49	0.28	0.20	0.06	0.59	0.84	0.33	0.72	0.87	0.55
1979	0.23	1.86	0.90	0.34	0.22	0.09	0.25	0.04	0.58	0.74	0.47	2.38	0.67
1980	0.88	1.36	0.87	0.80	0.15	0.15	0.29	0.08	0.51	0.22	2.28	2.61	0.85
1981	0.58	1.38	0.43	1.45	0.40	0.59	0.11	0.07	0.52	1.54	1.55	1.46	0.83
1982	1.98	1.89	0.69	0.78	0.20	0.04	0.05	0.02	0.07	1.83	1.11	1.94	0.88
1983	2.50	2.67	1.28	0.33	0.20	0.20	0.62	0.04	0.08	0.46	2.80	0.68	0.98
1984	2.35	1.57	0.95	0.90	0.90	0.15	0.18	0.03	0.29	1.81	1.61	0.85	0.97
1985	0.18	0.70	0.58	0.77	0.30	0.10	0.01	0.01	0.15	1.32	0.57	0.49	0.43
1986	1.88	2.03	1.41	0.65	0.95	0.26	0.19	0.02	0.08	0.25	1.34	1.80	0.90
1987	2.05	1.18	1.43	0.74	0.62	0.44	0.05	0.01	0.01	0.04	1.09	1.50	0.76
1988	0.91	0.96	0.99	0.96	0.59	0.28	0.05	0.04	0.15	0.39	2.01	1.00	0.69
1989	1.58	0.52	1.01	0.85	0.06	0.04	0.21	0.07	0.03	0.91	2.39	0.91	0.72
1990	1.81	2.15	0.81	0.22	0.16	0.77	0.09	0.04	0.03	1.60	4.04	1.91	1.13
1991	1.44	3.04	0.39	0.66	0.21	0.06	0.06	1.34	0.09	0.03	1.98	1.83	0.91
1992	3.36	1.27	0.28	0.88	0.10	0.05	0.03	0.07	0.22	1.05	1.22	0.72	0.77
1993	1.37	0.18	1.31	1.26	0.64	0.41	0.05	0.04	0.01	0.14	0.54	1.78	0.65
1994	1.36	1.80	1.37	0.31	0.08	0.34	0.07	0.01	0.06	0.46	1.44	1.95	0.76
1995	1.61	1.70	1.34	0.47	0.08	0.10	0.05	0.07	0.03	1.11	4.02	1.72	1.02
1996	1.54	1.19	0.46	1.12	0.32	0.09	0.02	0.01	0.15	1.03	0.94	0.95	0.65
MEAN	1.50	1.45	1.00	0.70	0.38	0.25	0.13	0.15	0.19	0.84	1.71	1.57	0.82
% MAD	184%	178%	122%	86%	46%	30%	16%	18%	23%	102%	210%	192%	100%

Station Name: CARNATION CREEK AT THE MOUTH
Station Number: 08HB048

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
16-Sep-73	0.013	16-Sep-73	0.013
4-Sep-74	0.057	4-Sep-74	0.057
3-Aug-75	0.091	3-Aug-75	0.091
9-Aug-76	0.045	9-Aug-76	0.045
19-Aug-77	0.035	19-Aug-77	0.035
4-Aug-78	0.037	4-Aug-78	0.037
29-Aug-79	0.037	29-Aug-79	0.037
13-Aug-80	0.069	13-Aug-80	0.069
24-Aug-81	0.06	24-Aug-81	0.06
3-Sep-82	0.006	3-Sep-82	0.006
24-Aug-83	0.016	12-Oct-83	0.015
29-Aug-84	0.024	29-Aug-84	0.024
3-Aug-85	0.004	3-Aug-85	0.004
7-Sep-86	0.015	7-Sep-86	0.015
31-Aug-87	0.009	25-Oct-87	0.007
11-Aug-88	0.018	11-Aug-88	0.018
13-Sep-89	0.022	13-Sep-89	0.022
12-Aug-90	0.02	12-Aug-90	0.02
11-Jul-91	0.029	31-Oct-91	0.013
1-Aug-92	0.014	1-Aug-92	0.014
25-Sep-93	0.007	8-Oct-93	0.006
30-Aug-94	0.004	30-Aug-94	0.004
21-Jul-95	0.013	21-Jul-95	0.013
MEAN	**0.028**		**0.027**
% MAD	**3.43%**		**3.33%**

Station Name: **SAN JOSEF RIVER BELOW SHARP CREEK**
Station Number: **08HF006**
Natural or Regulated: N
Drainage Area (sq.km.): 64.50
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	50	40	11
Longitude	128	9	51

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1990					1.77	1.77	0.94	0.57	0.41				
1993					4.98	1.82	0.89	0.95	0.72	1.89	8.52	10.00	
1994	10.90	10.00	11.20	5.36	2.85	3.22	1.52	2.31	7.87	11.80	18.70	16.90	8.54
1995	6.91	10.30	7.18	6.13	1.00	0.91	1.01	3.14	0.77	18.10	19.10	11.80	7.18
1996	16.70	8.47	8.28	12.20	4.02	4.61	1.29	1.64	3.73	11.60	7.60	12.90	7.75
MEAN	11.50	9.59	8.89	7.90	2.92	2.47	1.13	1.72	2.70	10.85	13.48	12.90	7.82
% MAD	147%	123%	114%	101%	37%	32%	14%	22%	35%	139%	172%	165%	100%

Station Name: SAN JOSEF RIVER BELOW SHARP CREEK
Station Number: 08HF006

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
15-Aug-93	0.598	9-Oct-93	0.573
26-Jul-94	0.855	26-Jul-94	0.855
21-Jul-95	0.539	21-Jul-95	0.539
MEAN	**0.664**		**0.655**
% MAD	**8.48%**		**8.38%**

Station Name: SARITA RIVER NEAR BAMFIELD
Station Number: 08HB014
Natural or Regulated: N
Drainage Area (sq.km.): 162.00
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	48	53	34
Longitude	124	57	54

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1948			21.30	29.20	15.40	4.25							
1949				18.10	11.20	3.88	4.37	4.84				31.30	
1950	13.70	46.60	45.30	35.90	12.50	5.48	1.83	1.93	3.12	39.20	30.40	57.90	24.40
1951	39.30	36.80	12.80	9.91	7.69	1.82	0.76	0.48	5.88	20.30	40.30	26.00	16.70
1952	21.40	47.40	15.60	26.30	14.50	16.70	1.61	5.57	2.77	3.08	25.00	45.90	18.70
1953	68.50	39.20	33.50	15.20	12.50	3.47	3.59	4.07	11.50	42.20	56.90	53.80	28.70
1954	26.10	70.30	12.30	23.10	4.92	7.15	6.89	2.05	5.26	30.60	61.00	40.60	23.80
1955	17.10	14.60	8.96	27.90	37.10	20.80	4.31	5.04	3.84	23.80	27.90	34.40	18.80
1956	42.50	14.50	29.30	19.40	11.10	14.00	3.40	1.02	6.17	37.20	21.60	62.70	22.00
1957	10.60	18.20	23.20	17.30	5.56	3.24	4.92	5.73	5.73	10.60	13.20	45.30	13.60
1958	64.80	46.20	13.80	15.10	2.11	1.01	0.54	0.69	5.42	27.30	16.60	60.20	21.00
1959	29.30	15.60	26.40	25.80	6.89	7.47	2.61	1.38	8.39	17.90	16.80	44.20	16.90
1960	46.20	30.00	18.30	32.60	15.40	9.71	1.02	1.76	6.39	26.70	45.50	32.70	22.10
1961	106.00	55.80	34.60	18.60	12.00	4.59	1.72	0.77	5.61	20.90	22.50	33.90	26.30
1962	19.30	17.80	10.30	24.70	10.20	8.28	2.89	7.60	3.63	25.10	71.80	58.30	21.60
1963	5.89	52.80	28.70	16.70	9.42	1.08	3.87	3.54	1.46	46.40	50.50	34.40	21.00
1964	40.20	17.90	26.40	12.90	8.99	6.48	11.80	5.23	11.30	14.30	19.00	16.60	16.00
1965	31.90	27.90	8.76	17.80	10.80	2.01	0.74	1.27	0.88	32.70	35.70	44.00	17.80
1966	52.70	20.00	31.30	9.67	5.26	5.89	3.46	2.15	5.55	24.20	39.70	60.90	21.80
1967	35.80	24.40	28.90	9.80	6.06	2.29	1.05	0.59	4.15	69.20	23.40	47.80	21.20
1968	64.80	34.30	33.40	14.30	6.30	4.85	3.93	6.08	10.60	38.30	38.00	36.90	24.30
1969	12.90	19.50	20.00	26.70	15.00	4.09	1.39	3.34	27.50	17.40	30.40	41.60	18.30
1970	23.00	15.00	16.50	22.20	4.16	1.01	0.91	1.29	5.41	17.80	32.90	38.50	14.90
1971	31.10	29.30	30.40	17.20	13.20	9.87	3.41	2.68	5.48	29.80	57.50	11.30	20.00
1972	33.20	41.70	41.40	27.20	6.38	1.45	11.10	1.09	4.65	2.95	29.10	57.80	21.50
1973	56.70	28.40	22.00	7.29	11.10	14.60							
1976				16.60	13.60	7.26	6.25	4.00	4.98	12.20	15.70	29.20	
1977	13.30	31.50	26.60	13.50	10.60	6.33	1.81	2.59	5.78	25.50	42.20	29.90	17.40

Station Name: SARITA RIVER NEAR BAMFIELD continued
Station Number: 08HB014

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1978	20.30	18.20	22.00	12.20	8.18	4.43	1.13	11.30	21.40	9.01	14.00	20.60	13.50
1979	6.59	49.90	21.90	13.30	11.50	6.64	10.20	1.94	12.90	19.20	11.90	58.70	18.50
1980	18.00	33.10	17.30	20.50	3.64	2.60	6.33	1.18	8.71	6.70	48.80	51.40	18.10
1981	12.50	31.10	8.21	22.60	5.37	7.72	1.95	0.84	7.63	35.00	44.30	45.20	18.40
1982	40.80	48.70	17.40	20.50	7.71	2.15	1.79	0.98	2.24	48.20	28.20	48.40	22.10
1983	62.30	65.90	37.40	9.87	5.48	7.01	12.40	2.10	3.30	12.10	70.00	18.40	25.20
1984	41.60	35.60	21.40	15.10	10.80	2.86	2.67	2.09	3.41	40.80	52.20	21.30	20.80
1985	5.90	17.20	14.80	19.30	7.90	2.41	0.63	0.51	2.85	27.00	12.70	14.10	10.40
1986	48.30	31.10	36.90	19.60	21.10	7.08	3.41	0.83	1.55	7.51	35.40	37.60	20.80
1987	48.20	29.10	34.90	15.90	14.40	16.80	1.48	0.45	0.54	0.60	26.10	35.80	18.60
1988	27.10	23.30	26.70	23.50	17.70	8.40	2.01	0.96	2.43	7.67	47.20	22.90	17.40
1989	31.80	23.20	20.70	19.00	2.22	2.06	5.74	1.43	0.63	21.10	45.70	24.60	16.50
1990	34.30	35.90	21.20	7.08	4.05	14.50	2.09	1.00	0.94	32.60	72.10	38.50	21.90
1991	30.50	54.70	7.80	14.80	7.21	2.17	1.58	24.20	3.57	0.94	37.60	40.50	18.60
1992	69.30	32.40	5.88	16.30	3.34	1.17	0.67	0.99	4.63	22.20	24.70	19.60	16.70
1993	22.00	7.66	28.90	29.30	14.80	7.78	1.63	1.85	0.89	5.49	14.30	41.70	14.80
1994	34.20	42.40	40.30	10.30	3.80	10.90	2.03	0.76	2.19	14.20	40.70	51.60	21.00
1995	40.10	38.50	33.00	11.40	2.09	2.90	1.03	1.53	0.84	27.60	83.20	49.10	24.20
1996	42.30	33.40	14.60	33.70	10.20	3.27	0.95	0.44	3.48	25.30	24.60	29.00	18.40
MEAN	35.05	32.89	23.36	18.83	9.82	6.21	3.33	2.94	5.58	23.16	36.30	38.78	19.64
% MAD	178%	167%	119%	96%	50%	32%	17%	15%	28%	118%	185%	197%	100%

Station Name: SARITA RIVER NEAR BAMFIELD
Station Number: 08HB014

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
17-Sep-50	1.3	17-Sep-50	1.3
26-Aug-51	0.39	26-Aug-51	0.39
18-Aug-52	0.523	18-Aug-52	0.523
13-Aug-53	1.62	13-Aug-53	1.62
14-Aug-54	1.71	14-Aug-54	1.71
8-Sep-55	0.807	8-Sep-55	0.807
4-Sep-56	0.743	4-Sep-56	0.743
23-Sep-57	1.97	23-Sep-57	1.97
16-Jul-58	0.431	16-Jul-58	0.431
12-Aug-59	0.871	12-Aug-59	0.871
2-Aug-60	0.37	2-Aug-60	0.37
20-Aug-61	0.576	20-Aug-61	0.576
30-Jul-62	1.02	30-Jul-62	1.02
7-Sep-63	0.461	7-Sep-63	0.461
11-Sep-64	1.59	11-Sep-64	1.59
6-Aug-65	0.449	6-Aug-65	0.449
7-Aug-66	1.12	7-Aug-66	1.12
27-Aug-67	0.458	27-Aug-67	0.458
9-Aug-68	1.53	9-Aug-68	1.53
8-Aug-69	0.482	8-Aug-69	0.482
14-Jul-70	0.831	14-Jul-70	0.831
15-Aug-71	1.2	15-Aug-71	1.2
3-Sep-72	0.824	3-Sep-72	0.824
9-Aug-76	1.35	9-Aug-76	1.35
19-Aug-77	0.825	19-Aug-77	0.825

Station Name: SARITA RIVER NEAR BAMFIELD continued

Station Number: 08HB014

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
6-Aug-78	0.881	6-Aug-78	0.881
28-Aug-79	1.75	28-Aug-79	1.75
13-Aug-80	1.06	13-Aug-80	1.06
24-Aug-81	0.659	24-Aug-81	0.659
1-Sep-82	0.699	1-Sep-82	0.699
24-Aug-83	1.1	24-Aug-83	1.1
27-Aug-84	2.03	27-Aug-84	2.03
26-Aug-85	0.33	26-Aug-85	0.33
15-Sep-86	0.396	15-Sep-86	0.396
29-Aug-87	0.342	21-Oct-87	0.329
15-Sep-88	0.393	15-Sep-88	0.393
23-Sep-89	0.477	1-Oct-89	0.458
12-Aug-90	0.543	12-Aug-90	0.543
11-Jul-91	0.791	31-Oct-91	0.694
24-Aug-92	0.349	24-Aug-92	0.349
27-Sep-93	0.710	2-Oct-93	0.681
4-Aug-94	0.692	4-Aug-94	0.692
22-Sep-95	0.631	22-Sep-95	0.631
MEAN	**0.867**		**0.863**
% MAD	**4.41%**		**4.40%**

Station Name: GOLD RIVER BELOW UCONA RIVER
Station Number: 08HC001
Natural or Regulated: N
Drainage Area (sq.km.): 1010
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	49	42	21
Longitude	126	6	22

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1956				137	190	158	66.9	15.5	45	138		208	
1957	29.7	23	47.3	78.7	99.3	49.1	36.7	31	68.5	55.9	63.2	203	65.8
1958	211		67.6	71.7	110	51.4	13.6	8.85	63.4	213	92.6	262	
1959		56.7	74.5	130	105	110	58	13.8	27.2	64.9	111	152	86.6
1960	32.2	107	57.9	146	150	123	39.8	20.1	32.2	168	109	128	92.7
1961	275	168	87.4	103	77.8	66.2	30	13.1	29.3	96	81.6	106	94.2
1962	169	101	22.6	97.7	70.3	50.6	21.4	41.9	25.9	150			
1963			76.5	48	62.8	44.4	48.6	16.1	22	205	190	197	
1964	87.3	65.4	58.6	78.8	106	147	88.4	47.6			98.2	81.3	
1965	68.1	91.2	54.6	68.5	75.5	42.9	17	7.55	6.14	297	105	167	83.7
1966	127	65.8	130	103	97.8	106	58	19.8	43.3	163	116	251	107
1967	116	88.1	55	40.9	133	127	32.9	11.5	29.6	270	93.8	163	97.1
1968	306	128	96.1	62.3	89.8	55.1	36.9	16.3	49.7	198	192	101	111
1969		66.6	67.2	128	205	147	35.7	26.6	80.3	75.6	185	108	
1970	56.7	69	57.3	93.4	92.5	54.2	21.1	12.6	23.3	55.8	61.8	45.7	53.4
1971	172	131	44.5	71	133	134	61.5	33.7	84.8	97.2	188	28.3	97.8
1972	28.3	62.5	188	77.9	156	156	78.2	21.6	63.8	12.5	96.5	155	91.4
1973	168	48.5	46	56.4	95.2	107	34.9	11.4	9.52	115	51.8	161	75.8
1974	162	73	101	107	114	153	94.5	34.4	22.3	26.5	146	167	100
1975	54.8	35.5	48.5	52	110	96.1	37.6	38.7	19.1	138	354	175	96.7
1976	108	53.1	58.5	65.7	140	122	85.5	38.8	38.2	64.2	95.9	180	87.7
1977	48.8	114	69.1	89.8	55.7	49.1	24.7	11.2	20	108	163	115	72
1978	50	67.9	106	39.3	50.1	50.1	18.1	28.7	81.1	69.4	82.7	47.2	57.4
1979	23.5	82.4	142	71.8	94.5	54.4	35	8.77	81.1	88.2	51.1	201	77.9
1980	50.4	98.1	60.6	88.2	68.8	43.2	29.3	8.87	43	36.1	184	261	80.8
1981	89.1	85.5	27	103	71.7	54.4	17.3	5.61	46.1	151	151	87.2	73.8
1982	67.7	111	47.3	42.1	99.5	111	36.1	13.9	22.8	179	80.8	105	76.1
1983	194	182	91.8	54.9	72.1	61.2	59.5	15.1	17.8	83.5	180	38.8	86.9

Station Name: GOLD RIVER BELOW UCONA RIVER continued
Station Number: 08HC001

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1984	163	103	94.2	72.9	90.5	70.4	47.4	16.8	40.5	157	105	63.7	85.4
1985	46	46.8	32.4	105	96.5	45	15.9	5.99	4.78	66.2	42.8	34.3	45.1
1986	184	116	147	55.8	124	60.6	30.4	7.82	6.13	20.7	156	150	88.2
1987	175	154	136	92.9	98.8	113	28.2	8.47	19.3	13.3	155	99.8	90.6
1988	82	114	87.9	120	128	91.3	48.2	18.3	17.9	53.7	166	87.8	84.3
1989	100	36.2	39	128	85.4	56.3	24.8	10.7	5.05	78.3	172	123	71.7
1990	104	73.3	70.1	86.8	53.1	52.8	17.5	6.53	5.3	179	333	127	92.2
1991	88.1	221	24.3	53.3	52.3	30.3	20.2	60.4	18.3	6.63	197	183	78.5
1992	248	152	47.2	47.1	42.1	22.1	9.58	6.59	17.7	128	125	50.7	74.5
1993	48.8	65.6	129	75.1	115	59.5	20.9	19.6	7.79	21.1	86.7	148	66.5
1994	116	73.3	144	97.3	50.1	51.9	18.7	8.68	15.5	72.1	80	160	74.1
1995	112	160	91.8	74.3	102	63.5	31.8	23.3	13.5	197	330	171	114
1996	176	88.2	55.2	171	56	40.5	17.8	9	19.3	107	92	60.7	74.2
MEAN	117.23	94.15	77.03	85.01	98.03	80.01	37.77	18.91	32.16	110.47	137.55	133.84	83.00
% MAD	141%	113%	93%	102%	118%	96%	46%	23%	39%	133%	166%	161%	100%

Station Name: GOLD RIVER BELOW UCONA RIVER
Station Number: 08HC001

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
16-Sep-56	8.35	16-Sep-56	8.35
1-Sep-57	12.50	6-Feb-57	9.59
25-Aug-58	5.26	25-Aug-58	5.26
23-Aug-59	10.70	23-Aug-59	10.70
12-Aug-60	14.50	12-Aug-60	14.50
26-Aug-61	7.50	26-Aug-61	7.50
12-Sep-62	8.54	12-Sep-62	8.54
9-Sep-63	8.41	9-Sep-63	8.41
26-Sep-65	5.16	26-Sep-65	5.16
5-Sep-66	13.30	5-Sep-66	13.30
28-Aug-67	8.75	28-Aug-67	8.75
7-Sep-68	9.36	7-Sep-68	9.36
10-Sep-69	14.10	10-Sep-69	14.10
31-Aug-70	6.18	31-Aug-70	6.18
25-Sep-71	17.60	28-Dec-71	16.40
14-Sep-72	7.47	14-Sep-72	7.47
17-Sep-73	5.20	17-Sep-73	5.20
27-Sep-74	11.50	27-Sep-74	11.50
26-Sep-75	9.89	29-Sep-75	9.55
27-Sep-76	16.70	2-Oct-76	13.90
20-Aug-77	9.21	20-Aug-77	9.21
8-Aug-78	8.55	8-Aug-78	8.55
13-Aug-79	7.54	13-Aug-79	7.54
23-Aug-80	6.65	23-Aug-80	6.65
22-Aug-81	3.76	22-Aug-81	3.76
3-Sep-82	9.47	3-Sep-82	9.47
24-Aug-83	8.05	13-Oct-83	6.23
25-Aug-84	12.50	25-Aug-84	12.50
27-Sep-85	3.57	2-Oct-85	3.42

Station Name: **GOLD RIVER BELOW UCONA RIVER continued**
Station Number: **08HC001**

Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
19-Sep-86	4.25	19-Sep-86	4.25
10-Sep-87	5.10	10-Sep-87	5.10
15-Sep-88	6.42	15-Sep-88	6.42
22-Sep-89	3.80	5-Oct-89	3.63
27-Sep-90	4.27	27-Sep-90	4.27
27-Sep-91	7.11	12-Oct-91	4.59
26-Aug-92	4.47	26-Aug-92	4.47
27-Sep-93	4.83	11-Oct-93	4.18
31-Aug-94	6.01	31-Aug-94	6.01
25-Sep-95	8.37	25-Sep-95	8.37
MEAN	**8.33**		**8.01**
% MAD	**10.04%**		**9.65%**

Station Name: **BEDWELL RIVER ABOVE URSUS CREEK**
Station Number: **08HC004**
Natural or Regulated: N
Drainage Area (sq.km.): 114
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	49	24	16
Longitude	125	44	51

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1990					18	19.8	7.27	3.77	1.77				
1991	12.1	38.3	4.39	11.4	16.5	11.5	8.5	21.8	3.37	1.74	34.9	28.9	15.9
1992	51.3	30.1	8.53	19	9.99	7.83	3.37	2.76	8.06	26.2	17.6	7.61	16
1993	10.1	10.4	19.9	17	27.1	14.7	5.68	6.86	1.53	6.97	17.7	23.3	13.5
1994	21.8												
1995										20.6	44.6	29.7	
1996	13.8	5.94	5.49	22	12.1	12.4	6.78	3.59	5.94	20.1	17.9	8.84	11.2
MEAN	21.82	21.19	9.58	17.35	16.74	13.25	6.32	7.76	4.13	15.12	26.54	19.67	14.15
% MAD	154%	150%	68%	123%	118%	94%	45%	55%	29%	107%	188%	139%	100%

Station Name: BEDWELL RIVER ABOVE URSUS CREEK
Station Number: 08HC004

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
23-Sep-90	1.14	2-Oct-90	1.04
27-Sep-91	1.64	6-Oct-91	1.14
25-Aug-92	1.32	25-Aug-92	1.32
24-Sep-93	0.95	10-Oct-93	0.94
22-Sep-95	1.82	22-Sep-95	1.82
MEAN	**1.37**		**1.25**
% MAD	**9.71%**		**8.84%**

Station Name: ZEBALLOS RIVER NEAR ZEBALLOS
Station Number: 08HE006
Natural or Regulated: N
Drainage Area (sq.km.): 181
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	50	0	52
Longitude	126	50	33

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1960	17.2	24.6	17.6	29.3	29	27.1	11.4	11.9	12.1	46.4	31.9	31.8	24.2
1961	63	51	25.5	24.3	15.1	15	9.78	7.01	12.2	22.8	20.8	31.3	24.7
1962	38.8	23.2	8.08	22.7	14.3	12.5	6.72	13.9	16.8	30.9			
1963	21.1	56.8	18.7	18.1	19.1	11.6	15.2	6.52	18.2	52.4	47.5	53.8	28
1964	26.7	27.6	17.9	20.2	20.1	24.8	29	16.3	16.8	33.2	30.3	24.6	23.9
1965	26.2	27.1	13.4	17	17.6	11.9	7.27	4.75	3.39		37.1	56.8	
1966	53.3	30.9	42.5				14.9	12.4	48.6	43.4	26.2	91.8	
1967	139	77.4	43.1	20.8	26.2	23.2	17.4	7.72	70.4	115	33	74.5	54
1968	109	41.6	32.6	27.2	19.6	19.4	19.9	9.62	51.8	244	140	68.6	65.5
1969		13.1	24.3	34.2	33.4	25.9	10.7	15.3	25.8	18.5	50.6	34.1	
1970	19.6	20	19.1	19.4	28.1	13.3	9.14	8.98	13.8	15.1	16.1	17.8	16.7
1971			16.5	19.2	25.5	28.2	17.1	20.6	30.2	43.5	66.4	12	
1972	11.2	24.9	46.4	28	31	30.3	21.4	8.1	13.4	7.75	25.2	42.6	24.2
1973	46.3	18.5	13.6	15.6	22.1	20.2	12.6	6.17	11.2	33.7	17.1	44.6	21.9
1974	40.7	27.3	28.1	24.3	26.7	29.9	23	11.1	10.8	14.4	32	43.1	25.9
1975	21.7	15.8	13.1	11.8	21.7	19.8	12	16.1	7.49	38.9	109	43	27.5
1976	34.2	16.9	18.8	18.1	35.7	29.6	27.5	16.4	17.3	22.5	28.9	64.9	27.7
1977	18	34	25.3	24.5	19.4	15	12	6.55	8.23	32.6	43.1	31.6	22.4
1978	18.3	21.2	26.8	11.2	13.3	11.8	6.08	10.3	27.2	22	35.3	19.4	18.5
1979	11.9	23.3	26.5	14	18.9	15.4	13.5	5.19	23.8	22	15.4	54	20.3
1980	19.1	26.8	17.8	23.2	17.8	12.1	11.7	5.89	22.7	12.3	48	71.6	24
1981	34.3	40.7	14	32.4	19.9	25.9	8.33	5.21	18.9	40.5	39.3	24.4	25.1
1982	24.7	32.5	13.2	11.9	19.3	21.1	12.8	8.33	15.3	38	26.8	29.8	21.1
1983	49.9	50.5	24.6	14	13.7	19.2	19.8	9.15	11.1	21.6	43.7	17.8	24.4
1984	40.8	31	23.6	22.2	24.6	17.2	16.2	9.88	23.3	38.9	31	19.2	24.8
1985	16.2	16.5	10.2	24.1	19.3	12.2	7.2	4.29	3.16	29.8	16	12.3	14.3
1986	56.5	33.2	36.4	18.6	32.6	16.7	14.2	4.66	4.35	8.94	39.2	37.8	25.2
1987	55.7	41	34.8	28.1	24.5	38.3	9.45	5.58	15.2	11.6	46.7	31.1	28.4

Station Name: ZEBALLOS RIVER NEAR ZEBALLOS continued
Station Number: 08HE006

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAD
1988	27.5	31.7	24	27.4	29.1	22.8	14.5	8.79	15.6	19.1	45.5	23.9	24.1
1989	33.4	10.3	14.3	26.6	17.6	15.4	11.7	5.95	4.23	22.8	45.8	36.4	20.4
1990	33.5	24	19.5	18.5	13.1	15	8.19	5.6	4.06	49.6	96.8	41.7	27.4
1991	28.4	64	9.06	13.1	13.8	8.62	6.96	21.3	6.59	4.83	55.4	53.8	23.5
1992	75.7	39.7	9.71	16.1	12.9	6.6	4.48	4.53	9.45	34.9	26.8	17	21.5
1993	15.3	16.6	36.3	22.2	25.1	16.4	8.5	10.1	4.42	9.68	26.4	38.1	19.1
1994	27.7	26.6	38.1	23.1	13.9	16.1	7.96	5.65	10.6	28	35.3	54.5	24
1995	29.4	39.5	21.1	15.8	13.7	12.4	7.97	10.2	4.96	54.1	83.2	44.6	28
1996	58.1	28	20.1	58.3	16.8	16.5	6.51	4.84	8.29	26.2	25.3	20.9	24.1
MEAN	38.35	31.33	22.83	22.10	21.24	18.82	12.78	9.32	16.80	36.39	42.70	39.31	25.78
% MAD	149%	122%	89%	86%	82%	73%	50%	36%	65%	141%	166%	153%	100%

Station Name: ZEBALLOS RIVER NEAR ZEBALLOS
Station Number: 08HE006

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
12-Aug-60	7.22	12-Aug-60	7.22
26-Aug-61	4.90	26-Aug-61	4.90
24-Sep-62	4.68	24-Sep-62	4.68
8-Sep-63	4.34	8-Sep-63	4.34
10-Sep-64	8.76	10-Sep-64	8.76
10-Sep-65	3.12		
22-Aug-66	9.50	22-Aug-66	9.50
16-Aug-67	5.48	16-Aug-67	5.48
5-Aug-68	6.13	5-Aug-68	6.13
8-Sep-69	5.39	8-Sep-69	5.39
30-Aug-70	4.79	30-Aug-70	4.79
27-Sep-71	8.43	27-Dec-71	7.31
14-Sep-72	4.73	14-Sep-72	4.73
14-Sep-73	4.89	14-Sep-73	4.89
27-Sep-74	6.36	27-Sep-74	6.36
24-Sep-75	5.95	29-Sep-75	5.90
27-Sep-76	9.59	20-Oct-76	7.77
15-Sep-77	4.33	15-Sep-77	4.33
7-Aug-78	4.09	7-Aug-78	4.09
28-Aug-79	4.32	28-Aug-79	4.32
22-Aug-80	4.94	22-Aug-80	4.94
21-Aug-81	3.80	21-Aug-81	3.80
2-Sep-82	5.62	2-Sep-82	5.62
24-Aug-83	6.03	13-Oct-83	6.01
25-Aug-84	8.11	25-Aug-84	8.11
27-Sep-85	2.73	6-Oct-85	2.58

Station Name: **ZEBALLOS RIVER NEAR ZEBALLOS continued**
Station Number: **08HE006**

Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
19-Sep-86	2.97	19-Oct-86	2.75
10-Sep-87	4.32	10-Sep-87	4.32
15-Sep-88	5.37	15-Sep-88	5.37
27-Sep-89	3.90	30-Sep-89	3.84
25-Sep-90	3.73	25-Sep-90	3.73
27-Sep-91	4.21	12-Oct-91	3.48
1-Aug-92	3.37	1-Aug-92	3.37
25-Sep-93	3.88	10-Oct-93	3.61
3-Sep-94	3.88	3-Sep-94	3.88
24-Sep-95	3.95	24-Sep-95	3.95
MEAN	**5.22**		**5.15**
% MAD	**20.24%**		**19.98%**

Station Name: **NAHMINT RIVER NEAR PORT ALBERNI**
Station Number: **08HB012**
Natural or Regulated: N
Drainage Area (sq.km.): 140
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	49	47	22
Longitude	124	59	24

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MAD
1924								3.03	15.8	67	43.9	27.4	
1925	29.1	39.2	16	18.5	23.5	13.4	7.8	4.88	3.18	1.2	25.8	53	19.5
1926	15.6	47.5	15.3	13.9	19.1	10.1	4.78	5.79	1.93	45.3	31.1	44.1	21.1
1927	35.6	22.6	23.9	17.9	28.1	26.3	13.6	5.13	21.4	49.4	36.9	14.5	24.6
1928	48.2	24.3	29.1	15.2	28.9	12.1	4.2	1.53	5.97	25.6	35.6	29.6	21.7
1929	9.04	3.19	11.5	15.5	19.3	22.3	9.73	5.18	2.31		6.26	33.7	
1930	9.59	45.6	12.8	28.2	12.7	16.1	5.04	1.97	8.2	14.7	23.2	25.6	16.7
1931	54.8	18.1	26.5	16.1									
MEAN	28.8	28.6	19.3	17.9	21.9	16.7	7.53	3.93	8.40	33.9	29.0	32.6	20.7
% MAD	139%	138%	93%	86%	106%	81%	36%	19%	41%	163%	140%	157%	100%

Station Name: NAHMINT RIVER NEAR PORT ALBERNI
Station Number: 08HB012

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
13-Aug-24	1.23	13-Aug-24	1.23
27-Sep-25	1.82	24-Oct-25	1.01
24-Sep-26	1.37	24-Sep-26	1.37
23-Aug-27	3.54	23-Aug-27	3.54
9-Sep-28	0.98	9-Sep-28	0.98
21-Sep-30	1.24	21-Sep-30	1.24
MEAN	**1.70**		**1.56**
% MAD	**8.19%**		**7.54%**

Station Name: UCONA RIVER AT THE MOUTH
Station Number: 08HC002
Natural or Regulated: N
Drainage Area (sq.km.): 185
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	49	42	32
Longitude	126	5	52

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MAD
1957				15.8	21.3	14.7	11.8	9.92	16.7	9.7	10.5	39.1	
1958	41.7	39.8	12.9	12.1	22.1	15.9	5.99	2.61	14.5	40.4	23	61.2	24.3
1959	25.3	9.25	16.1	23.4	23.8	26.3	18.6	4.49	12.7	13.1	19.8	31.7	18.8
1960	6.12	26	11.6	29.6	27.8	23.2	12.6	6.03	6.53	34.7			
1961	57	36.4	19.4	20.1	18.6	18.9	10.9	4.48	6.55	17	13.7	19.2	20.1
1962	26	17.7	5.24	19.7	14.9	14.6	7.99	8.7	6.37	25.1			
1963		48.6	16.7	11.4	15.7	15	14.7	5.44	5.4	45.4	33.4	38.4	
1964	20	15.9	11.7	14.3	19.4	32.5	24.9	11.5	6.58		16.9	13.8	
1965	12.5	16.9	9.31	11.4	13.8	11.7	6.42	4.18	1.86	48.3	24.1	28.7	15.8
1966	28.5	15.2	23.5	19.1	17.7	22.8	17	8.34	11.9	25.9	25.7		
1967		16.8	11.2	7.52	21.8	27.7	11.8	4.93	7.05	47.2	21.3	37	
1968	62.6	21.2	18	9.4	17.6	15.5	11.5	5.38	9.6	48.8	33.9	18.5	22.7
1969		10.4	14.2	23.1	34.1	30.8	12	7.8	17.4	14.5	31.6	22.5	
1970	11	12.6	10.4	15.6	17.9	17.2	7.98	4.61	6.63	11.8	13.1	10	11.5
1971			10.4	13.9	25.7	28	19.9	12.8	14.2	20.1	34.8	5.88	
1972	6.28	15	33.2	16.7	24.9	25.3	17.3	6.31	9.46	4.08	16	27.1	16.8
1973	26.5	11.2	10.6	10.5	23.8	20.6	14	5.4	2.85	21.5	13.6	34.1	16.3
1974	28.3					31.6	25.5	15.3	9.48	7.41	26.2	28.9	
1975	13.2	7.43	11.4	12.3	23.6	24.8	15.1	12.1	6.53	30.2	79	27.9	22
1976	21.5	12.2	11.9	12.8	26	24.8	22.6	13.5	10.3	12.5	19.5	31	18.3
1977	9.97	23.4	14.6	18	14.7	16.7	7.26	3.99	7.13	22.9	30.1	20.1	15.6
1978	13.2	16.6	22.1	9.36	14.5	18.8	9.63	10.6	20.5	15.1	20.1	12.3	15.2
1979	4.9	18.7	22.9	11.8	20.5	14.4	11.5	2.09	17.5	16.4	10.4	40.2	15.9
1980	12.4	23	13.3	17.7	17.3	15.6	11	3.33	8.08	8.13	33.1	51.2	17.8
1981	28.8	26.5	8.72	20.9	19.6	15.9	5.59	2.13	10.6				
1984									7.63	30.2	19.2	11.1	
1985	10.5	9.31	6.59	18.4	21.1	14.3	6.89						
1986	36.6	22.3	28.7	11.6	28.4	21.3	9.58	3.14	1.84	5.65	28.6	27.8	18.8

Station Name: **UCONA RIVER AT THE MOUTH continued**
Station Number: **08HC002**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MAD
1987	33	28	25.6	16.4	23	26.2	10.7	3.88	4.86	2.5	28.8	18	18.3
1988	16.1	19.1	16.4	22.6	27.5	22.5	15.5	6.76	4.18	9.71	31.1	17.6	17.4
1989	17.4	8.49	9.86	24.8	19.1	17	7.48	3.2	1.45	16.9	34.2	20.9	15.1
1990	19.6	13.2	13	16.7	13.5	17.2	5.83	1.38	1.17	29.8	64.8	24.8	18.4
1991	14.9	40	4.8	10.8	14.4	11.3	7.16	15.2	4.79	1.74	33.1	29.9	15.5
1992	44.3	27.9	10.2	14.3	10.8	9.33	4.23	2.63	3.63	25	23.7	11.2	15.6
1993	10.3	13.6	22.6	16.3	26.6	16.3	5.91	4.82	1.63	3.74	15.6	27.3	13.7
1994	23	14.7	28.3	18.2	13.5	16	6.88	2.88	4.02	13.1	21	36.7	16.6
1995	24	30.2	18.7	12.8	23.1	20	12	5.27	3.21	33.6	59	30.1	22.6
1996	27.7	19.4	14	31.4	13.9	13.1	7.2	2.47	5.25	20.8	19	12.6	15.5
MEAN	22.9	20.2	15.4	16.4	20.3	19.7	11.7	6.3	7.8	20.9	27.3	26.3	17.5
% MAD	131%	115%	88%	94%	116%	112%	67%	36%	45%	119%	156%	150%	100%

Station Name: UCONA RIVER AT THE MOUTH
Station Number: 08HC002

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
1-Sep-57	3.48	9-Oct-57	2.68
26-Aug-58	1.70	26-Aug-58	1.70
23-Aug-59	3.28	23-Aug-59	3.28
14-Sep-60	3.49	20-Jan-60	3.15
23-Sep-61	2.16	23-Sep-61	2.16
12-Sep-62	2.25	12-Sep-62	2.25
8-Sep-63	2.87	8-Sep-63	2.87
11-Sep-64	3.93	11-Sep-64	3.93
26-Sep-65	1.15	26-Sep-65	1.15
5-Sep-66	4.12	5-Sep-66	4.12
26-Sep-67	2.13	26-Sep-67	2.13
7-Sep-68	2.82	7-Sep-68	2.82
9-Sep-69	4.46	30-Jan-69	3.39
30-Aug-70	2.27	30-Aug-70	2.27
25-Sep-71	5.07	25-Sep-71	5.07
14-Sep-72	2.74	21-Oct-72	2.24
17-Sep-73	1.63	17-Sep-73	1.63
27-Sep-74	4.63	1-Nov-74	2.90
27-Sep-75	3.20	29-Sep-75	3.03
27-Sep-76	5.81	20-Oct-76	3.61
14-Sep-77	3.35	4-Oct-77	3.33
8-Aug-78	3.37	8-Aug-78	3.37
13-Aug-79	1.48	13-Aug-79	1.48
23-Aug-80	2.70	23-Aug-80	2.70
21-Aug-81	1.67	21-Aug-81	1.67
19-Sep-86	1.09	21-Oct-86	0.76
10-Sep-87	2.12	24-Oct-87	0.85
15-Sep-88	2.21	15-Sep-88	2.21
22-Sep-89	1.04	5-Oct-89	1.00

Station Name: **UCONA RIVER AT THE MOUTH continued**
Station Number: **08HC002**

Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
23-Aug-90	0.73	23-Aug-90	0.73
27-Sep-91	1.88	12-Oct-91	1.08
2-Sep-92	1.28	2-Sep-92	1.28
27-Sep-93	1.07	11-Oct-93	0.82
30-Aug-94	1.86	10-Oct-94	1.58
26-Sep-95	2.08	26-Sep-95	2.08
MEAN	**2.60**		**2.32**
% MAD	**14.84%**		**13.24%**

Station Name: BENSON RIVER NEAR PORT ALICE
Station Number: 08HE003
Natural or Regulated: N
Drainage Area (sq.km.): 228
Discharge in: m^3/sec

	Degrees	Minutes	Seconds
Latitude	50	24	4
Longitude	127	17	52

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	MAD
1925						12.6	6.18	2.71	2.72	3.56	32	46.4	
1926	16.9	42.9	18.6	9.99	21.1	8.54	9.78	5.62	2.15	22.2	17.3	46.8	18.4
1927	24.7	26.5	21.9	19.1	22.8	28.2	13.4	3.58	19.1	37.1	27.6	15.7	21.6
1928	40.1	18.7	27.8	13.6	29	9.22	4.45	3.26	3.31	30.2	40	41.8	21.9
1929	10.1	3.5	23.5	14.5	20.3	15.2	12	9.41	3.58	31.5	11.6	34.3	15.9
1930	7.41	52.2	16.9	26.4	11.6	23.1	4.31	1.98	10.4	15.8	30.2	62.2	21.6
1931	56.4	25.2	41.5	48.6									
MEAN	25.9	28.2	25.0	22.0	21.0	16.1	8.35	4.43	6.88	23.4	26.5	41.2	19.9
% MAD	130%	142%	126%	111%	105%	81%	42%	22%	35%	118%	133%	207%	100%

Station Name: BENSON RIVER NEAR PORT ALICE
Station Number: 08HE003

7-Day Average Low Flow (m^3/sec)			
Date of Occurrence	Period: Apr 1 to Sep 30	Date of Occurrence	Period: Jan 1 to Dec 31
21-Aug-25	1.71	19-Oct-25	1.29
24-Sep-26	1.73	24-Sep-26	1.73
23-Aug-27	2.65	23-Aug-27	2.65
9-Sep-28	0.87	9-Sep-28	0.87
27-Sep-29	2.12	29-Sep-29	1.93
12-Sep-30	1.38	12-Sep-30	1.38
MEAN	**1.74**		**1.64**
% MAD	**8.77%**		**8.26%**

APPENDIX D: Licenced Water Demand by Purpose

(Under separate cover)

LICENCE NUMBER	FILE NUMBER	PRIORITY DATE	SOURCE	QUANTITY	DEMAND (dam^3/yr)*
Conservation - Use of Water: 1 licence					
C049210	0330641	19760513	Thornton Creek	2.00 cfs	1786.00
			Total =	**2.00 cfs**	**1786.00**
Domestic*: 6 licences					
C035616	0281759	19680920	Duthie Brook	500.00 gpd	0.41
C045286	0329923	19680904	Mountview Creek	500.00 gpd	0.41
C045287	0329924	19680904	Mountview Creek	500.00 gpd	0.41
C045720	0316682	19730402	North Brook	500.00 gpd	0.41
C053495	0364597	19780824	Ferdinand Spring	1500.00 gpd	1.24
F004377	0241190	19050130	Maurus Creek	5000.00 gpd	4.15
			Total =	**8500.00 gpd**	**7.05**
Industrial - Ice Making: 1 licence					
C109594	0142788	19410128	Mercantile Creek	72000.00 gpd	119.47
			Total =	**72000.00 gpd**	**119.47**
Industrial - Ponds: 1 licence					
C063981	1000610	19860520	Stepien Creek	0.77 cfs	687.61
			Total =	**0.77 cfs**	**687.61**
Industrial - Work Camps: 1 licence					
C043108	0322621	19740218	Rankin Creek	5000.00 gpd	8.30
			Total =	**5000.00 gpd**	**8.30**
Irrigation: 2 licences					
C045286	0329923	19680904	Mountview Creek	0.55 acft	0.68
C045287	0329924	19680904	Mountview Creek	0.63 acft	0.78
			Total =	**1.18 acft**	**1.46**
Storage: 2 licences					
C059671	0355942	19800122	Ginnard Creek	5.00 acft	6.17
C061275	0223971	19590210	Sharp Creek	1.60 acft	1.97
			Total =	**6.60 acft**	**8.14**

LICENCE NUMBER	FILE NUMBER	PRIORITY DATE	SOURCE	QUANTITY	DEMAND (dam^3/yr)*
Waterworks* - Local Authority: 10 licences					
C024206	0219135	19580128	Mercantile Creek	9125000 gal/yr	20.74
C026923	0219135	19610329	Mercantile Creek	9125000 gal/yr	20.74
C029963	0260155	19650104	Mercantile Creek	9125000 gal/yr	20.74
C035653	0285794	19690618	Mercantile Creek	182500000 gal/yr	414.83
C059670	0355942	19800122	Ginnard Creek	40150000 gal/yr	91.26
C059672	0368723	19810602	Meares Creek and Close Creek	54750000 gal/yr	124.45
C061232	0231916	19600715	Meares Creek and Close Creek	25550000 gal/yr	58.08
C061233	0316777	19730424	Ginnard Creek	91250000 gal/yr	207.42
C061234	0223971	19590210	Sharp Creek	54750000 gal/yr	124.45
C110817	1000238	19831130	Number One Creek	21000000 gal/yr	47.73
			Total =	**497325000 gal/yr**	**1130.44**
Waterworks* - Other: 4 licences					
C058489	0368013	19810304	Itatsoo Creek	3500.00 gpd	2.90
C059711	1000151	19830320	Brother Creek	35600.00 gpd	29.54
C061343	1000117	19830107	Esowista Creek	10000.00 gpd	8.30
C061385	1000084	19821015	Mercantile Creek	100000.00 gpd	82.97
			Total =	**149100.00 gpd**	**123.70**

* Assumes that domestic and waterworks are the authorized maximum daily licenced amount divided by 2, to estimate the average daily demand, then multiplied by 365 days, to determine the annual demand. All other licences represent total annual licenced volumes

APPENDIX E: Low Flow Licenced Water Demand by Drainage Area

(Under separate cover)

DRAINAGE AREA	PURPOSE	LICENCED QUANTITY	LOW FLOW WATER DEMAND	
			(litres/second)	(dam^3)
Mercantile Creek	Industrial	72000.00 gpd	3.79	29.46
	Waterworks	209875000 gal/yr	30.23	235.09
	Waterworks	100000.00 gpd	5.26	40.91
		Total Consumption =	**39.28**	**305.47**
Sharp Creek	Storage	1.60 acft	-0.25	-1.97
	Waterworks	54750000 gal/yr	7.89	61.33
		Total Consumption =	**7.63**	**59.36**
Meares Creek & Close Creek	Waterworks	80300000 gal/yr	11.57	89.95
		Total Consumption =	**11.57**	**89.95**
Brother Creek	Waterworks	35600.00 gpd	1.87	14.57
		Total Consumption =	**1.87**	**14.57**
Itatsoo Creek	Waterworks	3500.00 gpd	0.18	1.43
		Total Consumption =	**0.18**	**1.43**
Other	Domestic	1500.00 gpd	0.08	0.61
		Total Consumption =	**0.08**	**0.61**
Salt Water	Domestic	7000.00 gpd	0.37	2.86
	Irrigation	1.18 acft	0.19	1.46
	Waterworks	10000.00 gpd	0.53	4.09
	Waterworks	152400000 gal/yr	21.95	170.71
	Industrial	5000.00 gpd	0.26	2.05
	Industrial	0.77 cfs	21.81	169.57
	Storage	5.00 acft	-0.79	-6.17
	Conservation	2.00 cfs	0.00	0.00
		Total Consumption =	**44.31**	**344.57**

* Based on an estimated 90 day period demand assuming that: irrigation and industrial demands are totally withdrawn over the 90 day period, domestic and waterworks demand are the authourized licenced maximum daily for 90 days; storage balances demand, and therefore, is a negative demand over the 90 days; conservation and power are non-consumptive and, therefore, have no demand.

APPENDIX F: Pending Water Licence Applications by Purpose

(Under separate cover)

LICENCE NUMBER	FILE NUMBER	PRIORITY DATE	SOURCE	QUANTITY	DEMAND (dam^3/yr)*
Conservation - Use of Water: 1 licence					
Z111199	1001933	19960620	Johnstone Creek and Kennedy River	20.00 cfs	17860.00
			Total =	**20.00 cfs**	**17860.00**
Domestic*: 2 licences					
Z104115	1001534	19911224	ZZ Creek (65221)	500.00 gpd	0.41
Z104229	1000629	19860722	Windy Creek	500.00 gpd	0.41
			Total =	**1000.00 gpd**	**0.83**
Industrial - Enterprise: 2 licences					
Z104229	1000629	19860722	Windy Creek	2500.00 gpd	4.15
Z104231	1000872	19880621	Ginnard Creek	3000.00 gpd	4.98
			Total =	**5500.00 gpd**	**9.13**
Land Improvement: 1 licence					
Z100786	1001164	19891213	Chinnery Creek	0.40 acft	0.49
			Total =	**0.40 acft**	**0.49**
Power - General: 1 licence					
Z103771	1001213	19911031	Bulson Creek	1.00 cfs	893.00
			Total =	**1.00 cfs**	**893.00**
Storage: 1 licence					
Z104231	1000872	19880621	Ginnard Creek	6.00 acft	7.40
			Total =	**6.00 acft**	**7.40**
Waterworks* - Local Authority: 2 licences					
Z101985	1001455	19910523	ZZ Creek (63294)	54750000 gal/yr	124.45
Z104912	1001579	19920615	Mercantile Creek	450000 gal/yr	1.02
			Total =	**55200000 gal/yr**	**125.47**

* Assumes that domestic and waterworks are the authorized maximum daily licenced amount divided by 2, to estimate the average daily demand, then multiplied by 365 days, to determine the annual demand. All other licences represent total annual licenced volumes.

APPENDIX G: Fish Screening Requirements

(Under separate cover)

FISH SCREENING DIRECTIVE

Government of Canada
Department of Fisheries and Oceans

WATER INTAKE FISH PROTECTION FACILITIES

The Department of Fisheries and Oceans has prepared this document as a guide to assist in the design and installation of water intakes and fish screening in British Columbia and the Yukon Territory to avoid conflicts with anadromous fish. Additional precautions must be taken at marine intake locations where entrainment of fish larvae, such as eulachon and herring larvae, is a possibility. The screening criteria constitutes the Department's policy regarding the design and construction requirements pursuant to Section 28 of the Fisheries Act.

PROVISIONS OF THE FISHERIES ACT - SECTION 28

Every water intake, ditch, channel or canal in Canada constructed or adapted for conducting water from any Canadian fisheries waters for irrigating, manufacturing, power generation, domestic or other purposes, shall, if the Minister deems it neccessary in the public interest, be provided at its entrance or intake with a fish guard or a screen, covering or netting, so fixed as to prevent the passage of fish from any Canadian fisheries waters into such water intake, ditch, channel or canal.

The fish guard, screen, covering or netting shall have meshes or holes of such dimensions as the Minister may prescribe, and shall be built and maintained by the owner or occupier of the water intake, ditch, channel or canal subject to the approval of the Minister or such officer as the Minister may appoint to examine it.

The owner or occupier of the water intake, ditch, channel or canal shall maintain the fish guard, screen, covering or netting in a good and efficient state of repair and shall not permit its removal except for renewal or repair, and during the time such renewal or repair is being effected, the sluice or gate at the intake or entrance of the water intake, ditch, channel or canal shall be closed in order to prevent the passage of fish into the water intake, ditch, channel or canal.

PROCEDURES FOR INSPECTION AND APPROVAL OF INTAKE STRUCTURES

Diversions less than 0.0283 cms (one cubic foot per second): The intake structure shall be constructed in accordance with specifications indicated herein. Upon completion of construction and prior to operation the owner shall contact a local representative of the Department of Fisheries and Oceans to arrange for on-site inspection and approval of the installation. Permanently submerged screens must be inspected prior to installation.

Diversons greater than 0.0283 cms (one cubic foot per second): The owner shall submit to the Department of Fisheries and Oceans 2 sets of detailed plans of the proposed installation for review and approval prior to fabrication. Design drawings are required whenever the diversion quantity exceeds 0.0283 cms (1.0 cfs) or 817,200 L/day (180,000 Igpd) for industrial diversions (calculated on the basis of 8 hours/day) or 123,350 cmy (100 ac.- ft./year) for irrigation diversions (calculated on the basis of 100 days/year and 12 hours/day). The plans shall contain the following information:

1. Intake structure location and dimensions.
2. Maximum discharge capacity of diversion.
3. Screen dimensions.
4. Mesh size.
5. Screen material.
6. Fabrication details.
7. Minimum and maximum water levels at the intake site.
8. Provision for bypassing fish.

The intake structure shall then be constructed in accordance with the approved plans. Upon completion of construction and prior to operation, the owner shall contact the local representative of the Department of Fisheries and Oceans to arrange for on-site inspection and approval of the installation. Permanently submerged screens must be inspected prior to installation.

SPECIFICATIONS FOR INTAKE STRUCTURES WITHOUT PROVISION FOR AUTOMATIC CLEANING

1. Screen Material: The screen material shall be either stainless steel, galvanized steel, aluminum, brass, bronze, or monel metal. Stainless steel is preferred since corrosion is greatly reduced.

2. Screen Mesh Size: Clear openings of the screen (the space between strands) shall not exceed 2.54 mm (0.10 inch). The open screen area shall not be less than 50% of the total screen area. The following square-mesh wire cloth screens are recommended:

   - 7 mesh, 1.025 mm (0.041 inch) wire, 51% open, 2.54 mm (0.10 inch) openings; or
   - 8 mesh, 0.875 mm (0.035 inch) wire, 52% open, 2.25 mm (0.09 inch) openings; or
   - 8 mesh, 0.700 mm (0.028 inch) wire, 60% open, 2.54 mm (0.10 inch) openings.

3. Screen Area: A minimum unobstructed screen area (gross area) of 0.93 square metre (10 square feet) shall be provided for each 0.0283 cms (1cfs) of water entering the intake. The required screen area shall be installed below minimum water level. Screen area lost by framing shall not be included as part of the unobstructed screen area.

4. Screen Support: The screen shall be adequately supported with stiffeners or back-up material to prevent excessive sagging.

5. Screen Protection: The intake structure shall, where necessary, be equipped with a trash rack or similar device to prevent damage to the screen from floating debris, ice, etc.

6. Screen Accessibility: The screen shall be readily accessible for cleaning and inspection. Screen panels or screen assemblies must be removable for cleaning, inspection and repairs.

7. Allowable Openings: The portion of the intake structure which is submerged at maximum water level shall be designed and assembled such that no openings exceed 2.54 mm (0.10 inch) in width.

Design and Location: The design and location of the intake structure shall be such that a uniform flow distribution is maintained through the total screen area.

Fish Bypass: The intake shall be designed to provide a transverse velocity (the component of the velocity parallel and adjacent to the screen face) to lead fish to a bypass or past the screens before they become fatigued. In no case should the transverse velocity be less than double the velocity through the screen.

ECIFICATIONS FOR INTAKE STRUCTURES WITH PROVISIONS FOR AUTOMATIC CLEANING

The specifications are identical to those for intake structures thout provisions for automatic cleaning except that the minimum obstructed screen area (gross area) of 0.23 square metre (2.5 square et) need only be provided for each 0.0283 cms (1 cfs) of water entering e intake. However, a regular cleaning and maintenance schedule is quired to ensure seals and screen panels remain in good repair preventing pingement and entrainment of fish and debris.

For these self-cleaning intake structures, the location, design d juvenile fish avoidance system all affect operating characteristics. e final design, therefore, may incorporate modifications reflecting the st current technology available for minimizing adverse impact upon the sheries resource.

TERNATE FISH PROTECTION FACILITIES

Enquiries concerning the Department's requirements for indirect ıtakes, such as infiltration galleries and wells, for salt water ocean ıtakes, and for new methods or devices for screening intake structures ıould be directed to the Department of Fisheries and Oceans, Senior ıbitat Management Biologist.

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nversion Factors:

cubic foot per second (cfs) = 449 U.S. gallons per minute (U.S. gpm).
= 374 Imperial gallons per minute (Igpm).
= 1.98 acre feet per day (Ac.-Ft./day).
= 28.3 litres per second (L/sec.).
= 0.0283 cubic metres per second (cms)

0.10 inch = 3/32" (approx.) = 2.54 millimetres

ddresses for Correspondence and Approvals

- Senior Habitat Management Biologist
  Fraser River, Northern B.C. and Yukon Division
  Department of Fisheries and Oceans
  Room 330, 80 - 6th Street
  New Westminster, B.C. V3L 5B3 Phone: 666-6479

- Senior Habitat Management Biologist
  South Coast Division
  Department of Fisheries and Oceans
  3225 Stephenson Point Road
  Nanaimo, B.C. V9T 1K3 Phone: 756-7270

- Senior Habitat Management Biologist
  North Coast Division
  Department of Fisheries and Oceans
  Room 109, 417 - 2nd Avenue West
  Prince Rupert, B.C. V6J 1G8 Phone: 624-9385

Other Federal and Provincial agencies having jurisdiction in water ithdrawals and construction pertaining to watercourses in British Columbia nclude:

1. Transport Canada
   Canadian Coast Guard.

2. B.C. Ministry of Environment
   Fish and Wildlife Management.

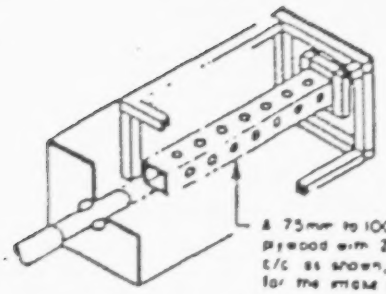
3. B.C. Ministry of Environment
   Water Management.

4. B.C. Ministry of Agriculture and Food.

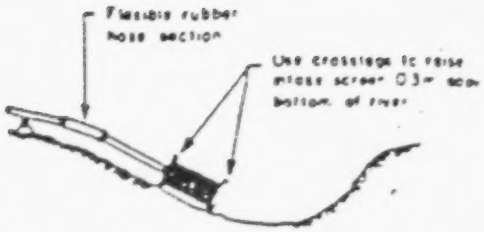
5. B.C. Ministry of Lands, Parks and Housing.

It may be necessary that several or all these agencies also be olicited for approvals prior to the installation of a water intake.

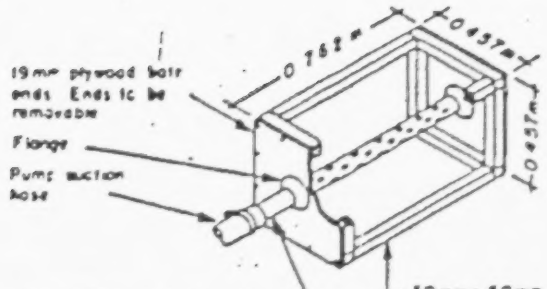
Revised January, 1986



A 75mm to 100mm square box of 19mm plywood with 25mm dia holes at 75mm c/c as shown, may be substituted for the frame part below.

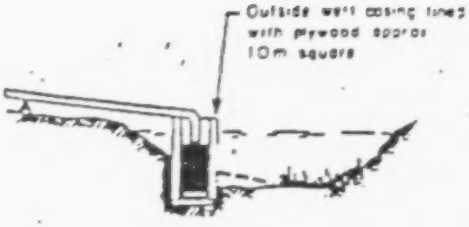


STANDARD INSTALLATION

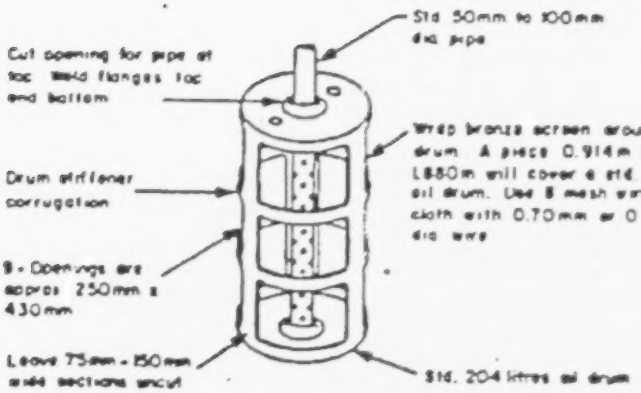


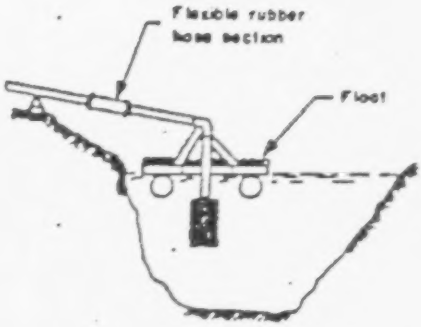
50mm - 100mm std pipe with the section inside the screen box perforated with 16mm dia holes at 50mm to 100mm c/c staggered

50mm x 50mm planed framing covered on 4 sides with bronze screen (wire cloth) stretched tight and fastened to the framing only. Plywood ends to be removable. Use 8 mesh wire cloth with 0.70mm or 0.64mm dia wire



INSTALLATION IN SHALLOW WATER MUDDY OVERGROWN BOTTOM


Std 50mm to 100mm dia pipe
Cut opening for pipe at top. Weld flanges top and bottom
Wrap bronze screen around drum. A piece 0.914m x 1.880m will cover a std. oil drum. Use 8 mesh wire cloth with 0.70mm or 0.64mm dia wire
Drum stiffener corrugation
8 - Openings are approx 250mm x 430mm
Leave 75mm - 150mm wide sections uncut
Std. 204 litres oil drum



INSTALLATION IN DEEP WATER

NOTE

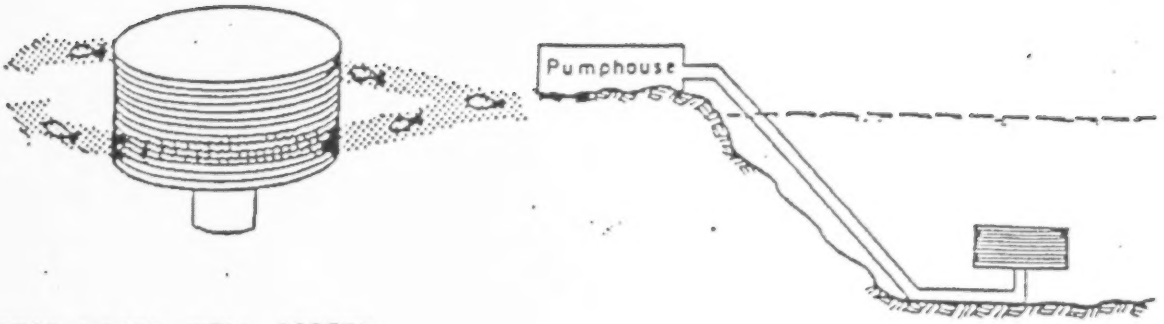
1. Oil drum shall be thoroughly washed out or steam cleaned before cutting openings
2. All loose rust shall be removed and the drum coated with metal primer. Two coats of machinery enamel or epoxy paint shall be applied before covering with wire cloth

NOTE

All screens shall be installed below minimum water level, shall be easily accessible for cleaning, and shall be cleaned of debris at regular intervals

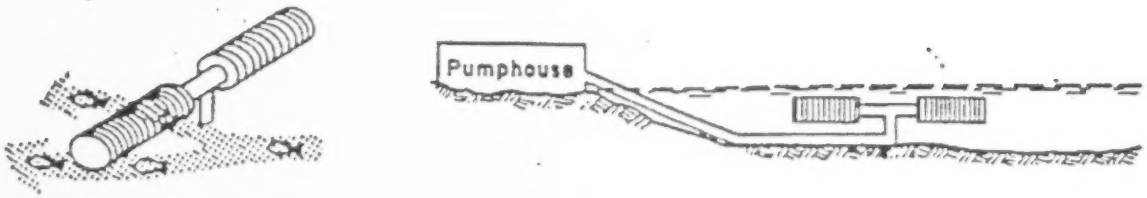
SMALL STATIONARY WATER INTAKE SCREENS

(For pumps of a capacity less than 28.3 L/sec [1cfs, 449 U.S. or 374 Igpm])



DEEP WATER WELL SCREEN

May be installed in lakes and the ocean.



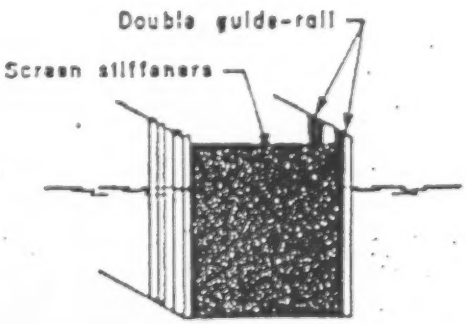
SHALLOW WATER WELL SCREEN

May be installed in lakes, pools, and stable areas in rivers.

Totally submerged cylindrical shaped stainless steel well screens provide for high intake capacity and large percentage of open area permitting water to enter at low velocities. Slot opening shall not exceed 2.54 mm (0.10 inch).

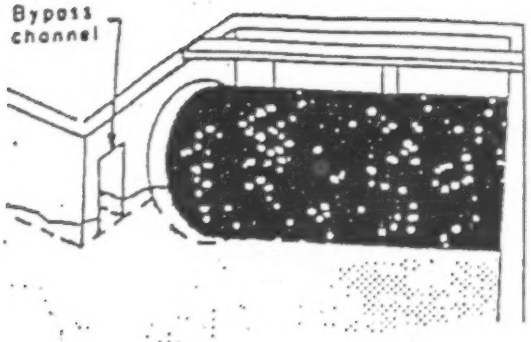
VERTICAL PANEL SCREENS

May be installed in rivers, lakes and the ocean. Generally, requires coarse trashracks, a sluice gate in river installations, double sets of guide-rails, and standby screen panels to allow for cleaning and repairs.



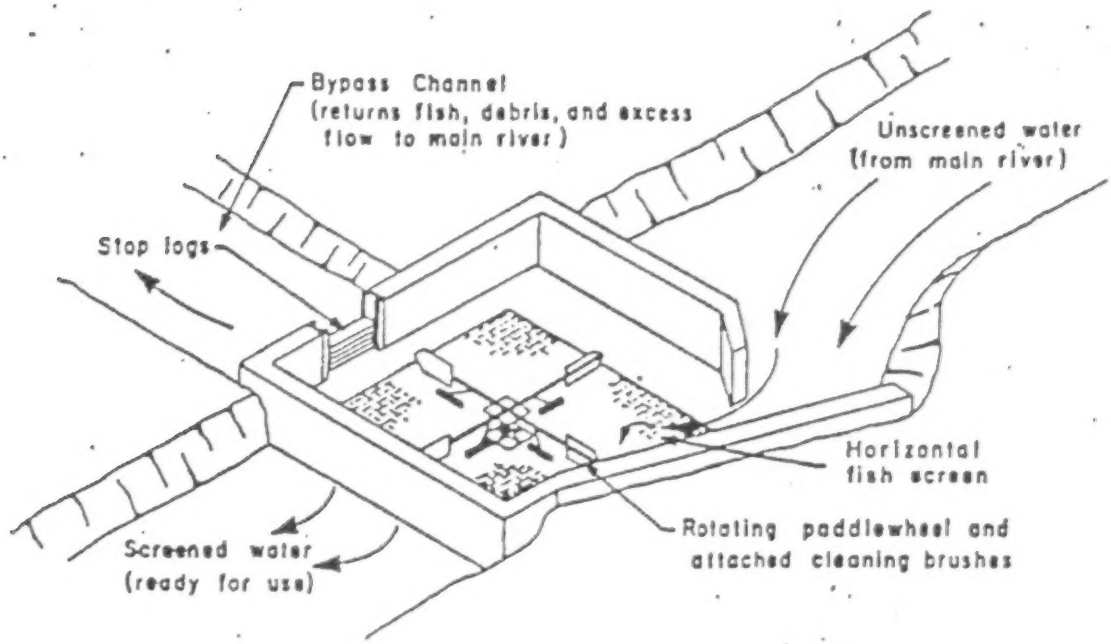
LARGE STATIONARY WATER INTAKE SCREENS

(For pumps of a capacity more than 28.3 L/sec [1 cfs, 449 U.S. or 374 Igpm])



REVOLVING DRUM SCREEN, HORIZONTAL AXIS

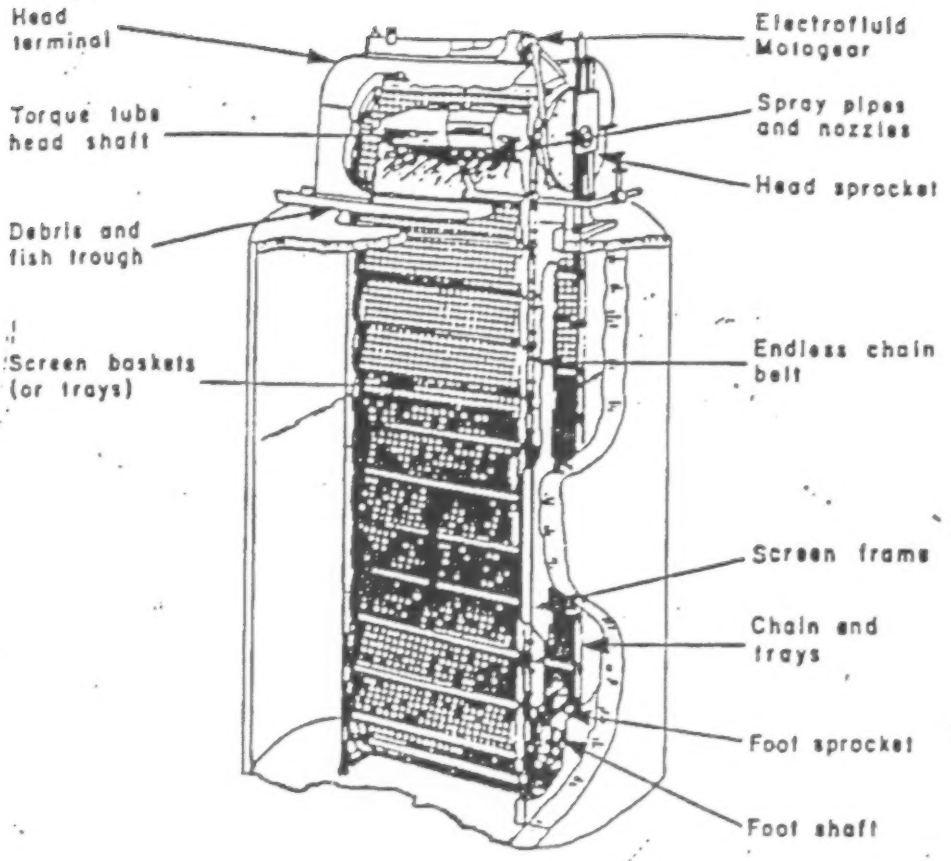
Generally, installed to divert fish from irrigation canals. Can be driven by a small motor or by a paddle wheel. To avoid juvenile fish impingement, a bypass channel is required near the front of the screen. Rubber seals are necessary along the base and sides.



FINNIGAN SCREEN

The horizontal, self-cleaning Finnigan Screen is another concept, generally installed to divert fish from irrigation or enhancement projects. The stationary horizontal screen is kept clean by a set of brushes attached to a revolving paddle wheel powered by the water current entering the structure. A portion of the flow, the suspended debris, and fish are directed to the bypass channel. The remainder of the flow passes through and below the screen for use as required.

IRRIGATION INTAKE SCREENS



CONVENTIONAL VERTICAL TRAVELLING SCREEN

May be installed in rivers, lakes and the ocean. A common screening method utilized by industry, these self-cleaning mechanical screens with modifications can prevent impact upon fish. Mounted flush to the stream bank (shoreline) or as pier intakes within streams and provided with an opening on the downstream end between the intake screens and trashracks, juvenile fish can generally escape entrapment. Rubber panel, side, and boot seals are required to prevent juvenile fish from gaining entry into the pumpwell. A safe bypass system is essential to return juvenile fish with debris back to the watercourse. Automatic controls are also necessary to ensure operation at a specific minimum head differential.

LARGE INDUSTRIAL AND DOMESTIC WATER INTAKE SCREEN